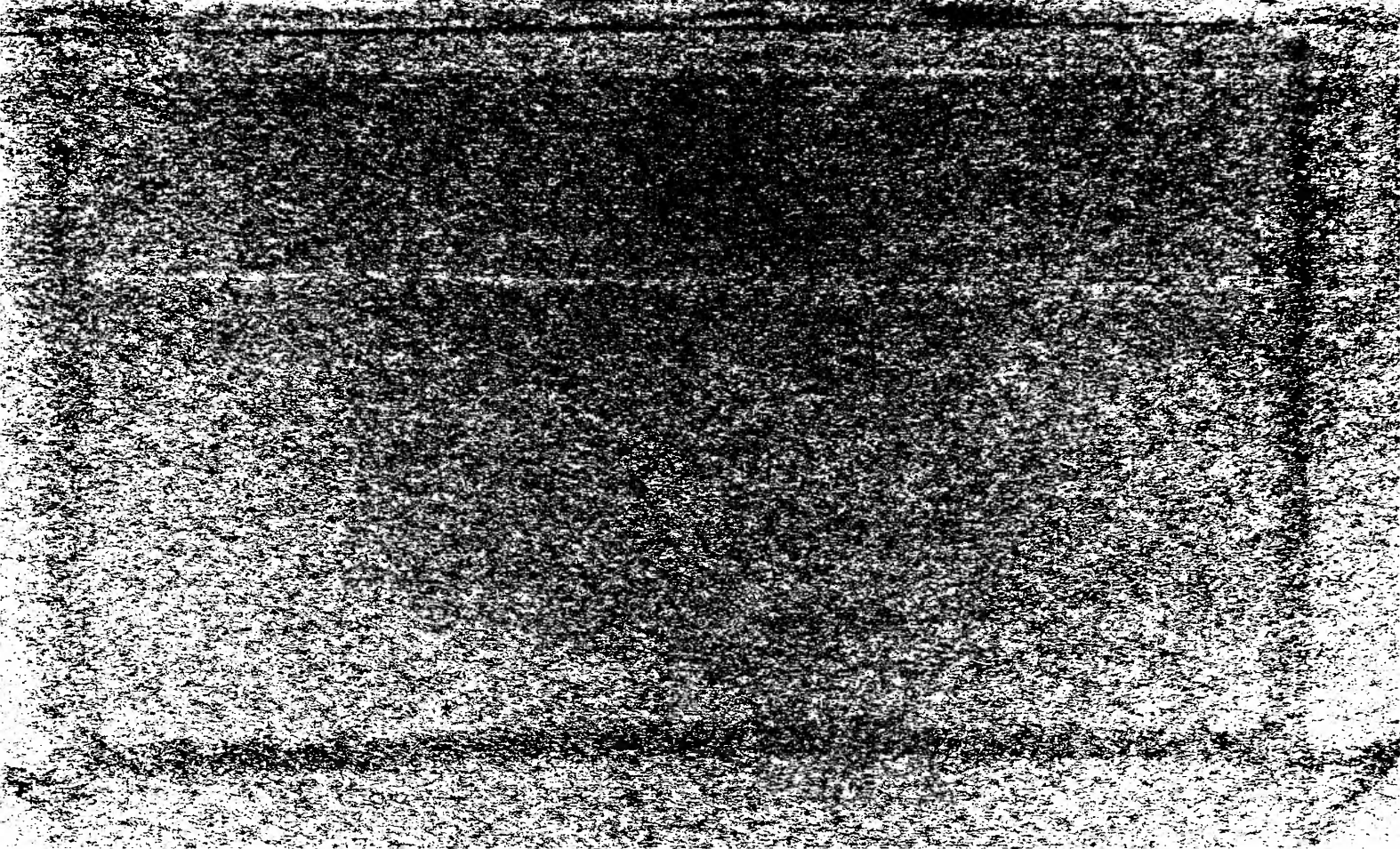

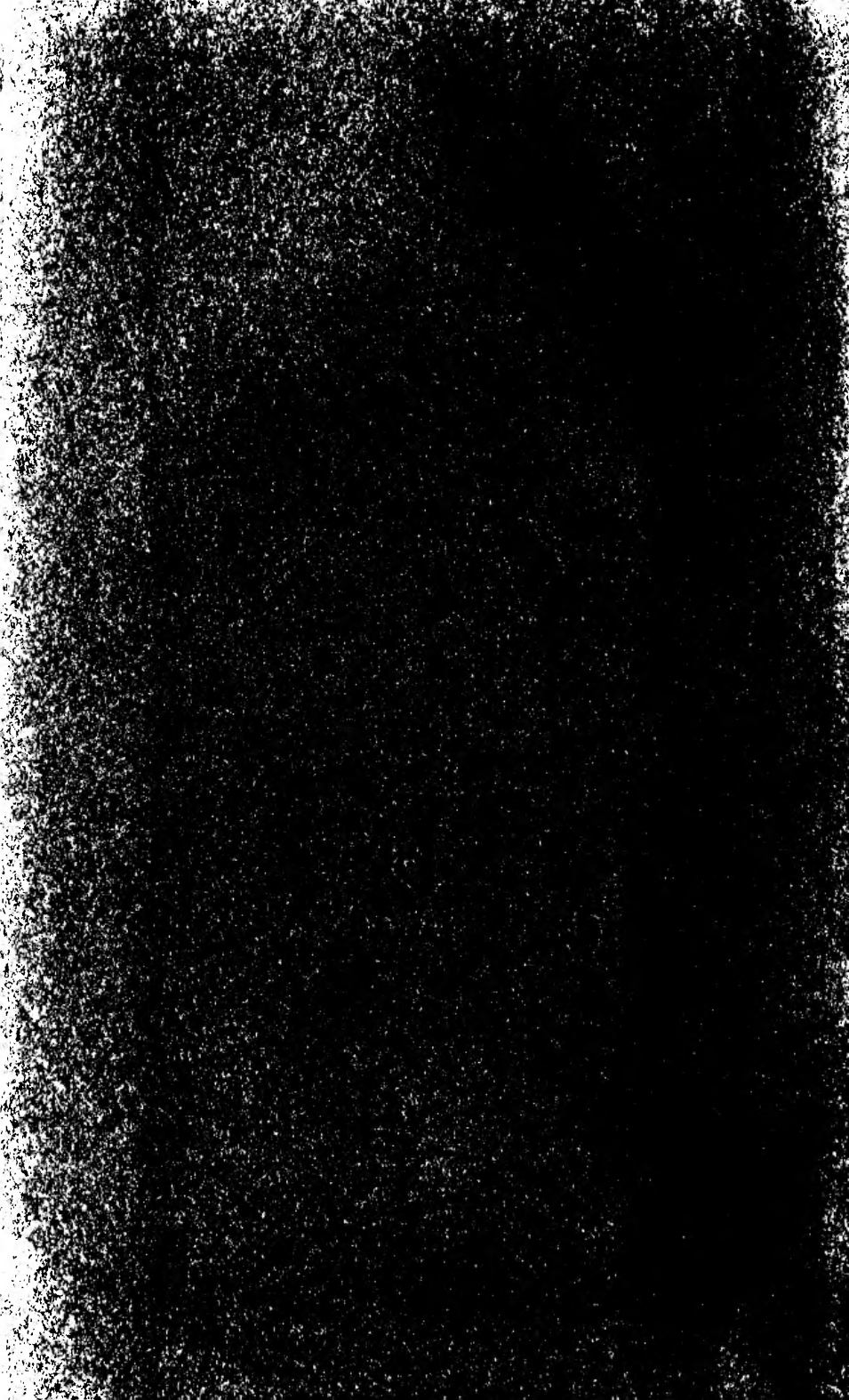

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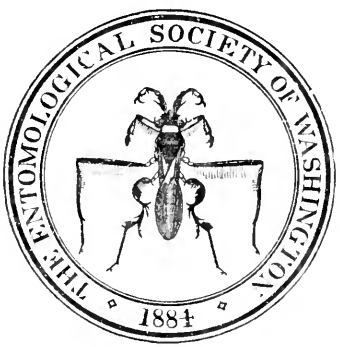

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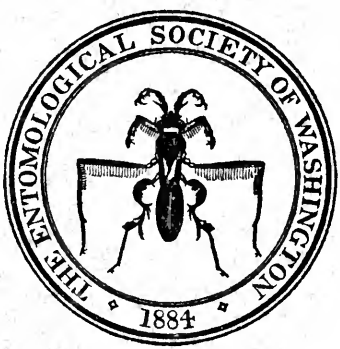

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VOL. XV 1913 No. 1

DESCRIPTION OF TWO NEW SPECIES OF NORTH AMERICAN TINGITIDÆ.

By Otto Heideman

Stal in 1873 founded the genus *Leptodictya*,[1] based on five species from Brazil which species he had described previously in his Hemiptera fauna of Rio Janeiro, 1858. Years later Dr. G. C. Champion[2] described two more species, collected in Guatemala and Panama; besides, he found in the former State specimens of Herrich Schaeffer's species, *Monanthia tabida*, which was described 1839 from Mexico. This species, unknown to Stal, Dr. Champion placed also in the genus *Leptodictya*, and added to Stal's diagnosis of the genus a few more new characters, of which the most important one may be quoted herewith: "The expanded opaque margins of the pronotum are formed by two layers of membrane meeting on the outer edge, this being easily seen when the insect is viewed sideways."

The genus *Leptodictya* has a wide range of distribution, from the neotropical region into the nearctic region. At the present time two new species have been found, and as they have not been recorded before from the United States, a description may follow herewith:

Leptodictya plana, new species.

Body elongate, oblong, extremely flat. Head short and narrow, with five rather long spines, two in front close together and one above them in the middle, the first three spines reaching to the base of second antennal joint; two other spines originate from the basal part of the head, projecting a little upwardly; the buccal laminæ broad, abruptly extended beyond the head, rounded at tip, the hind part somewhat narrower and reflexed at the edge, finely reticulated. Rostrum hardly reaching the middle coxæ.

[1] Stal, Enumeratio Hemipterorum, part III, pp. 121–127 (1873).
[2] Champion, Biologia Centrali Americana II, p. 23 (1897–1901).

Antennæ long, basal joint more than twice the length of the second, third joint slender and four times as long as the apical joint.

Pronotum narrowing anteriorly, finely punctured, at the disk feebly convex and the transverse depression behind very faint; humeri broadly thickened; the triangular posterior portion of pronotum somewhat depressed, pointed at apex; the three carinæ feebly raised; the lateral membranous margins of pronotum straight, not rounded, anteriorly rectangular, with two and three rows of small areoles; hood small with rows of minute cells, a little depressed at the sides, in front nearly triangular, behind obtusely rounded, at top a sharp carina with its apex projecting nearly in an upright position.

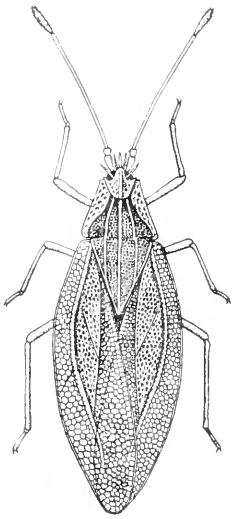


Fig. 1. *Leptodictya plana* Heidemann.

Elytra narrow and long, the sides feebly rounded, apical part obtusely shaped, discoidal area reticulate, long, fusiform, extending as far as the apex of abdomen, bounded by two prominent longitudinal nervures, a blackish narrow streak passes obliquely over the discoidal area in the direction of the outer nervure without touching the same; the subcostal margins very narrow, biseriate throughout; costal margins hardly broader than the discoidal area, irregularly netted, the cells rather small; some cross-nervures at the sutural area infuscated. The lateral expanded margins of pronotum and the head yellowish; surface of the thorax with the triangular prolongation somewhat greenish-gray; abdomen light brown.

Length, 3.2 mm.; width across the widest part of elytra, 1.2 mm.

Described from a single male specimen. Wistar, Indian Territory, July 3 (H. S. Barber).

Type: No. 15326, U. S. National Museum.

This species resembles in general appearance the Mexican species *Leptodictya tabida* H. Schaeffer. It has the same straight, membranous, lateral margins and the three linear carinæ of the pronotum; but otherwise it is quite different in being distinctly narrower across the elytra and the pronotal lateral margins are more opaque, the cells somewhat smaller and the veins less prominent; besides, the spines in front of head do not project beyond the second antennal joint. The young brood and foodplant are still unknown.

Leptodictya simulans, new species.

Body oval-elongate, flat and brownish. Head with five short, whitish spines; the three in front stick close together, making it appear as if there were only one thick, blunt spine; bucculæ somewhat convexly rounded, finely reticulated. Antennæ moderately long; basal joint subequal in length with the terminal, both black; the second half as long as the first and dark brown. Eyes black, rather prominent. Pronotum grayish-yellow, finely punctured, with three low whitish carinæ; the neck blackish; lateral margins of pronotum distinctly rounded, opaque, yellowish-white, and with two or three rows of areoles. The hood longer than broad, not covering the head, yellowish-white with rows of small areoles, the crest sharply carinate. Elytra oval-shaped, transparent, yellowish-white, strongly irideseent; lateral margins from the base to the apical part very feebly rounded but at the apex broadly rounded; discoidal area narrow and long, extending to the middle of elytra, the surface of the area a little concave, finely reticulated and with a conspicuous black narrow streak, which runs diagonally from the inner margin of the nervure toward the outer one, dividing the discoidal area into two parts; subcostal area with two rows of minute cells; costal margins broadest near the middle, irregularly areolated at the base, the areoles small, gradually becoming larger toward the apex, veins sometimes more or less infuscated, except at the inner part of the costal margins.

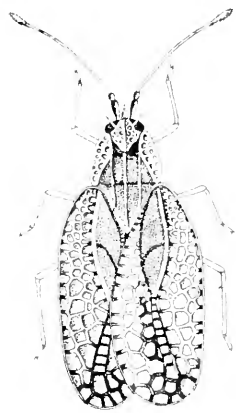


FIG. 2. *Leptodictya simulans* Heidemann.

Length, 3 mm.; width across the middle of elytra, 1.4 mm.

Described from several specimens, male and females: Old Point Comfort, Virginia, April 19, 1891 (E. A. Schwarz); Drummond, Virginia, June 7, 1905 (H. S. Barber); Alabama, (C. F. Baker); Clemson College, South Carolina (G. G. Ainslie).

Type: No. 15327, U. S. National Museum.

This North American tingid seems to belong to a group of species which have the membranous lateral margins of pronotum more or less rounded, instead of distinctly straight as in *Leptodictya plana* and *Leptodictya tabida* H. S.

The species is nearest allied to Champion's *Leptodictya cretata* from Guatemala, Central America. However, the North American species can be distinguished at once by a black, narrow streak that divides the discoidal area into two parts; furthermore, our insect is smaller, the areoles of the elytra somewhat irregularly arranged, and some of the nervures more or less infuscated. The

specimens from Old Point Comfort were found on the beach of Chesapeake Bay swept ashore by the waves.

A NEW SCELIONID FROM QUEENSLAND, AUSTRALIA, PARASITIC ON ACRIDIID EGGS, WITH DIAGNOSIS OF AUSTRALIAN SPECIES[1]:

(Hymenoptera; Proctotrypoidea.)

By A. A. Girault.

Family Scelionidae.

Subfamily Scelioninae.

Genus SCELIO Latreille.

1. Scelio ovi, new species.

Normal position.

Female.—Length, 4 mm. more or less.

The same in all respects to *Scelio australis* Froggatt, but the scape, pedicel, and sometimes the first funicle joint of the antenna are reddish-brown like the legs instead of being black: also the venation differs in that the stigmal vein of *australis* is somewhat shorter, straight but at its extreme tip bent: this vein in *ovi*, however, is longer, its whole length slightly convexly curved, the convexity distad; the blunted end of the vein in *australis* points proximo-caudad; in *ovi*, the extreme end of the vein has a slight blunted appearance which is turned slightly distad. The wing fumation also differs in that there is a distinct stigmal spot in *australis*, round and covering the basal half of the stigmal vein and the apex of the marginal, while in *ovi* the spot is elongate, does not involve the marginal vein, though originating at the base of the stigmal, but follows the latter on each side for a half, two-thirds, or sometimes, its whole length; it is thus less clear cut than in *australis*. The sculpture of both species is practically the same; ventrad, the proximal half of the second (first body) segment of the abdomen is punctate; the striations of the same segment dorsad are coarser than that of the following segments; the metathorax at the mesial region is sulcate, the sulci with transverse divisions; laterad, in the dorsal aspect it is densely punctate and covered with whitish pubescence. This refers to both species. The antennæ are 12-jointed. The coxæ are darker, the mandibles bidentate, the teeth acute; the proximal funicle joint is always suffused with brownish (*ovi*).

[1] Contribution No. 1 from the Entomological Laboratory of the Sugar Experiment Stations of Queensland, Mackay.

From the species *choetoicetes* Froggatt, *ovi* differs in having the proximal funicle joint of the antenna red, the wings darker and all the abdominal segments in the dorsal aspect longitudinally striate; also probably in venation, but the description does not allow comparison.

From 15 specimens, 2–3 inch objective, 1-inch optic, Bausch & Lomb.

Male.—The same, but differing in abdominal and antennal characters. Thus, the abdomen is blunt at extreme apex; the antennæ are 10-jointed, less compressed fusiform, but the middle of the flagellum widest; the first funicle joint is not so long and the following joints not so wide; the scape and pedicel are nearly black, the first three funicle joints with more brownish but still dark, the remaining joints reddish-brown like the legs. Antennæ with very fine, close white pubescence. Joint 3 of funicle widest, cup-shaped, the second joint intermediate in length between the first and third.

From two specimens, the same magnification.

Described from 15 female and 2 male specimens reared from an acridiid egg-mass found in alluvial soil in a cane field adjoining the Mulgrave River at Nelson (Cairns), North Queensland, April 8 to 10, 1912; also 2 females captured on the surface of the ground along a bare strip in a paddock or meadow near acridiid egg-masses; the same general locality, dark compact soil, April 19, 1912. The first eggs mentioned were most likely those of *Locusta danica* Linnæus, which has been very numerous at Nelson the past several months, but *Locusta australis* has also been mixed in with it to a certain extent.

Subsequently the following specimens were found in my collections: Five females captured from the surface of the ground along a road, April 29, 1912; a female June 10, 1912, at light in the evening at a private residence; a pair taken by sweeping in a forest at Nelson, February 16, 1912; a female similarly captured, January 29, 1912; three males captured with a female of *australis* from the ground in a meadow, Nelson, June, 6, 1912; and a female from the ground among the young of *danica*, May 6, 1912.

Habitat: Australia—North Queensland, East Coast (Cairns District).

Types: No. *Hy / 989*, Queensland Museum, Brisbane, 2 males 2 females, tag mounted.

Cotypes: Catalogue No. 15250, U. S. National Museum, Washington, D. C., 4 females remounted on tags from alcohol.

2. Scelio australis Froggatt.

Scelio australis Froggatt, 1910, Farmer's Bulletin No. 29, Department of Agriculture, New South Wales, Sydney, pp. 34–35, figures 1, 1*a*.

This species was described from the Herbert River, Queensland, from specimens reared from the eggs of *Locusta australia*. In a forest near Nelson, North Queensland, I captured a male and a female specimen of this species by sweeping grass, April 19, 1912. Its original description does not give all the necessary specific characters which I have noted in foregoing. Thus, for this genus, in order to describe species recognizably it is necessary to give not only the sculpturing in detail, but also the degree of wing fumation, the shape of the stigmal spot, the details of the venation and those of coloration. A variation in the coloring of the antenna seems to be correlated with a variation in the venation. Of itself, I think one would hesitate to consider a species of this genus distinct did it differ from another only in the fact that the first two or three antennal joints were of a different color, since a variation of this kind would be expected to occur with many of the species.

I describe the male herewith:

Like the female, but differing in the following characters: The antennæ are as in the male of *ovi*, but differ in coloration in that they are brown at base, only the first two funicle joints and the pedicel being darker brownish and the tip of the scape blackish; they are alike structurally. One male specimen, captured later, was only two-thirds the size of the others. Later, I found *australis* common at Nelson, usually accompanying *ovi*. The following specimens were captured: Two females, four males from surface of the ground in a meadow, May 18, 1912; a female June 6 in the same place; three females on the ground along a road, April 29, 1912; two females May 6, on the ground mingled with young *danica* and finally two females from the ground, along the grassy borders of a tram-line at Nelson, mingled with the young of *danica*, May 18, 1912.

In the original description of *australis*, Froggatt (loc. cit. p. 34, ¶ 7) seems to have made a mistake in this statement: "the thoracic segments, which are well defined, are thickly marked with fine parallel striæ on the undersurface; these striæ are shorter, as there is a smooth shining patch at the junction of each segment." The abdomen was doubtless in mind, since the ventral thorax is like the dorsal, the abdomen striate in my specimens, while both the figure of Froggatt and his statements to me in a letter bear this out.

3. **Scelio froggatti** Crawford.

This species was described in the Proceedings of the United States National Museum (Washington, D. C., U. S. A.), vol. 41, 1911, from Childers, Queensland. On December 24, 1911, while sweeping along the floor of a forest on the coast of North Queens-

land, opposite Double Island (10 or more miles north of Cairns) I captured a male *Scelio* which is undoubtedly this species. It is both like *ovi* and *australis*, but the striation along the dorsal and ventral aspects of the abdominal segments is rugolose, the striæ curved and interlacing around punctures and hence shorter and not nearly parallel; the antennæ in this specimen are wholly honey-yellow, but otherwise like those of the males of *ovi*. The strong striæ converging toward the mouth are conspicuous; the proximal tarsal joint in the posterior legs is decidedly shorter than with either *ovi* or *australis*, and the size is smaller (at least with this specimen). The parapsidal furrows distinguishable, as distinct as in the other species noted (*ovi* and *australis*).

There are six species of the genus now known from Australia, all parasitic upon acridiid eggs. I give herewith a diagnosis of them, constructed from the literature and the foregoing specimens. The three species occurring in Queensland are distinct from the three known from New South Wales and this is expected from the difference in latitude.

KEY TO THE FEMALES OF THE AUSTRALIAN SPECIES OF SCELIO LATREILLE.

Black, the legs reddish brown or yellow, the fore wings infuscated.

I. Head smooth, polished, with a few scattered, fine punctures or a few converging striae..

Scape, pedicel, and at least first two or three joints of funicle fulvous; segments 1 and 2 of abdomen longitudinally striate, segment 3 finely reticulate, segment 4 with similar sculpture at base, the succeeding segments hardly sculptured; ventral segment 3 of abdomen with punctures on each side of meson and segment 4 with the same punctures but covering a smaller space. Face without striæ *pulchellus* Crawford

Scape, pedicel, proximal and apical funicle joints fulvous; abdominal segments all finely, longitudinally striate, but the fifth segment with a median smooth area and ventrad the segments all having the middle of each smooth; face with some striæ; abdomen dark brown.....*fulgidus* Crawford

II. Head rough, rugose or rugoso-punctate for a large part, especially at the vertex.

(1) Abdomen wholly longitudinally striate or rugulose, dorsad and ventrad, except maybe medially and at the incisions of the segments.

Abdomen longitudinally striate; parapsidal furrows distinct.

Antennæ wholly black.
Stigmal vein straight but bent at its extreme tip, the blunted end pointing proximo-caudad. Stigmal spot distinct, round, covering basal half of stigmal vein and apex of marginal.....*australis* Froggatt
Antennæ black with the scape, pedicel, and, usually, the first funicle joint reddish-brown.
Stigmal vein slightly, convexly curved along its whole length, the tip very slightly turned distad. Stigmal spot elongate, not involving the marginal vein.....*ovi* Girault
Abdomen longitudinally rugulose.
Antennæ wholly dark brown; parapsidal furrows more or less obliterated.....*froggatti* Crawford
(2) Abdomen only partly longitudinally striate, some of the segments finely punctate in the dorsal aspect.
Segments 3, 4, and 5 of the abdomen covered with fine, close, shallow punctures, giving them a shagreened appearance; fore wings lighter than usual; scape and pedicel of antennæ reddish brown. Beneath, abdomen finely longitudinally striate.....*chortoicetes* Froggatt

SUMMARY OF THE HOSTS OF SCELIO LATREILLE IN AUSTRALIA.

Species.	Host.	Authority.
australis Froggatt.....	*Locusta australis* Brunner, v. W.....	Froggatt, *l. c.*, p. 35.
chortoicetes Froggatt....	*Chortoicetes terminifera* Walker.....	Froggatt, *l. c.*, p. 36
froggatti Crawford.....	*Gastrinagus musicus* Fabricius.[1].....	Froggatt, *in litt.*, May 6 1912.
fulgidus Crawford.....	*Chortoicetes terminifera* Walker..... (given as *Pachytylus australis*)	Crawford, *l. c.*
ovi Girault.....	*Locusta danica* Linnæus.....	See above.
pulchellus Crawford ...	*Chortoicetes pusilla* Walker.....	Crawford, *l.c.*

[1] From what I can gather this appears to be a synonym of *Locusta danica* Linn. In the original description of the parasite, Crawford gave by mistake (as Mr. Froggatt informed me by letter) *Chortoicetes terminifera* as the host.

Though so far removed from the scene of actions of other species of the genus, yet the habits are the same in Australia as in North America, for instance.

I have to thank Mr. Walter W. Froggatt, Government Entomologist, New South Wales, for his kindness in furnishing me with Crawford's descriptions of the species of the genus and for a few facts in connection with hosts as noted.

CRITICAL NOTES ON SOME SPECIES OF MYMARIDÆ FROM THE SANDWICH (HAWAIIAN) ISLANDS, WITH COMPARATIVE NOTES ON AUSTRALIAN, NORTH AMERICAN, AND EUROPEAN FORMS.

(Hymenoptera; Chalcidoidea.)

By A. A. Girault.

I have recently obtained a few specimens of Mymaridæ from the Sandwich Islands through the kindness of Mr. Otto H. Swezey, all of the genus *Polynema* Haliday; also I have captured in Northern Queenlsand and in Fiji one or two species of the family common also to these islands and in one case to North America. The Myrmaridæ of Australia also, now, are tolerably well known to me. Inasmuch as the Sandwich Islands are situated in a position geographically between North America, Fiji, and Australia, it is interesting from the standpoint of geographical distribution of animals to make this comparison, since it will be shown as probable that most of the indigenous forms of the family occurring in Hawaii, North America, and Australia (also Europe) are quite peculiar to those continents, fulfilling our expectations. It is also shown probable that such species as are common to several of the continents or islands have been distributed through commerce or else are parasitic upon widely distributed species or genera or families of insects. I make the detailed comparisons herewith.

Subfamily GONATOCERINÆ.

Genus ALAPTUS Haliday.

1. Alaptus immaturus Perkins.

Perkins described this species in 1905 from Bundaberg, Queensland, Australia, it having been reared from leaves of sugar cane infested with leaf-hopper eggs, but these latter were doubtfully the host. In the second volume (part VI) of the Fauna Hawaiiensis, Cambridge, England (1910, p. 661), the same author records the species from the Sandwich Islands, "Oahu and probably all the islands; bred from the eggs of Psocidæ." But previously, also in the introduction to the bulletin containing the original description of the insect, on page xxiv, it was stated in regard to its host: "Eggs of Psocid feeding on fungus growing on honeydew excreted by leaf-hoppers." Thus, the doubtful host implied in the original description was given by mistake, probably, and the host is a psocid, as would be expected. Since, I have captured the species in several localities in North Queensland, once from the foliage

[1] Contribution No. 2, Entomological Laboratory, Sugar Experiment Stations, Mackay, Queensland.

of citron growing wild near the jungle, but which was imported and planted by a settler some years ago. I have compared the species with others of the genus in a paper on Australian Mymaridæ now in manuscript and it should suffice to say that it is a good species, but a typical one of the genus, there being no peculiarities which may be connected in any way with its habitat.

The occurrence of this species in the Sandwich Islands would appear rather remarkable to me did I not have reason to think that it was introduced there with the other Australian parasites of sugar-cane insects, as described in Bulletin No. 1 of the Hawaiian Sugar Planters' Association. No direct statement is made to that effect, but it seems very probable. If it was not intentionally introduced, then its presence can be explained by the fact that it is associated with commercial plants such as sugar cane and citrus fruits and was distributed by commerce. These explanations are the most likely and reasonable ones, for otherwise we would have to accept others which in this case would be not incredible, but less reasonable in the face of the first two. The species most probably is native to the east coast of Australia.

2. Alaptus globosicornis Girault.

This species was described from Florida in North America. It was recorded to have been reared from a coccid on citrus fruits in 1907. About three years later Girault recorded it from Honolulu, in the Sandwich Islands, where it had been captured in an office as early as 1900. It was thus found earlier in the Pacific than in North America. Late in 1911 and early in 1912 I captured a number of specimens of it in North Queensland, where it appears to be the commonest species of the genus, but forms what appears to be a distant color variety; the Hawaiian specimen also appears to be a similarly distinct variety. In Queensland the species was found only in settled areas where citrus fruits are not uncommon; in the Sandwich Islands the office where the species was captured was very probably an insectary or an entomological or quarantine office where imported insects and trees would likely be placed for a time. Thus, again, I think the explanation of the wide distribution of this species is that of commercial dispersal, the parasite being carried along with its host. This seems the most likely. The fact that the species is split into geographical varieties would tend to show that it has been distributed over its present-known range for some time, but a variation of this kind, namely, of general body coloration, does not necessarily have to have a long period of time for its consummation, but, I believe it is known, may ensue after the exposure of a comparatively small number of generations to the new climate. The species is a characteristic one, because of the submoniliform

antennal funicle, but it is as peculiar in its relation to North America and European species as it is to those of Australia.

Genus LEIMACIS Foerster.

A species of this genus (*peregrina* Perkins) has been described from Honolulu and I have an Australian species captured in North Queensland; the two species are distinct, since they differ in general coloration and markedly in the ciliation of the forewing and length of the antennal club.

Subfamily MYMARINÆ.

Genus ANAGRUS Haliday.

1. Anagrus armatus (Ashmead).

In my paper on Austrialian Mymaridæ, mentioned previously, I will give evidence that this species is common to North America, the Sandwich Islands, the Fijian Islands, and to Australia. The matter need not be gone into here, but I desire merely to account for its occurrence in these widely separated countries. The species was first described from Florida in North America, more than twenty years ago. Recently, I showed that it was very common in North America, and the evidence which I will present in the paper referred to shows that it is distributed from the east coast of the United States as far west as the Rocky Mountains and is parasitic upon leaf-hopper eggs deposited in the soft parts of various plants, those recorded being the grape and apple (both inferred, since the parasites appeared from twigs of those plants infested with external hosts which are very doubtful hosts of this parasite), an economic *Empoasca* (a definite, unpublished record from host egg in leaves) and from a *Liburnia* on grass; also Perkins records it from *Liburnia* or similar eggs in Australia, the plant doubtless sugar cane, another grass, but no statement is made that it was originally found on that plant. However, Perkins had discussed the parasite as an associate of the sugar cane and introduced it into the Sandwich Islands for the purposes of the economic entomology of that crop.

The above facts, namely, that the species occurs in four widely separated countries and that it is associated with cultivated plants widely transported in commerce, represent effect and cause, since I believe that little or no doubt can be entertained otherwise. The opportunities for the distribution of this insect during the last century from one continent to another by commerce have been enormous, for what plants have been more widely interchanged than the grasses and fruits? There is nothing to contradict this view. This species, also, is very similar to, yet dis-

tinct from, *brocheri* Schulz of Europe. In this connection, Perkins has stated: "*Anagrus* of the Mymaridæ attacks the eggs of the Delphacidæ alike in Europe, America, Australia, Fiji, and China, and even the species hardly differ in these countries."

Subgenus PARANAGRUS Perkins.

1. Paranagrus perforator Perkins.

This species was described from Fiji. It was obtained from the eggs of various genera of delphacid leaf-hoppers, usually in grasses, rarely in sugar cane, and was introduced into the Sandwich Islands in connection with the economic entomology of sugar cane. Its occurrence in those islands is thus accounted for, but just recently I have captured several specimens of it in North Queensland in an area planted with sugar cane and I have no doubt that its presence here is due to introduction with that plant; more than this, however, it may be the same species as *Paranagrus optabilis* Perkins described from Queensland, since the two forms are very much alike, and according to Perkins *optabilis* also occurs in Fiji. The two forms differ only in the presence of an exserted ovipositor in one (*perforator*) "for a length equal to that of all the joints of one of the hind tarsi taken together." But my Queensland specimens of *perforator* have the valves of the ovipositor exserted to an extent somewhat less than that described originally. Both specimens are connected with sugar cane.

Genus POLYNEMA Haliday.

1. Polynema reduvioli Perkins.

Of interest generically because of the lengthened proximal joint of the antennal funicle, this species was described from the Sandwich or Hawaiian Islands, it being parasitic upon leaf-hopper eggs in the leaves of sugar cane. Subsequently, it has been recorded from several islands of the Sandwich group. Mr. Swezey has sent me several specimens of it and I examine them herewith, with special reference to the relations of the species to North American, European and Australian species. As was to be expected, the species is closely related to those species like the type of *Stephanodes* Enock, *Polynema enockii* Girault, *Polynema psecas* Girault—and the lengthened proximal joint of the antennal funicle is correlated in all with the peculiarly broad fore wings bearing very fine discal ciliation and the intense coloration of the yellow part of the body; also the serrated scape. I am the more inclined, since seeing this species, to recognize Enock's *Stephanodes* with at least the rank of a subgenus, but await, before considering this, the comparison of the three and with an Australian form. I still hold back, also, because of the species *bifasciatipenne* Girault,

which has no correlated color nor fore wings, but is peculiar to itself.

At first I take the European species with lengthened proximal funicle joint—(*Stephanodes*) *Polynema enockii* (Girault). The females differ as follows: Funicle joints 4 and 5 are shorter and subequal in *reduvioli* and joint 5 is not nearly as long as joint 3 but distinctly shorter; also the fore wings are not quite so large, more graceful, bearing about 25 lines of fine discal ciliation; otherwise, I can not distinguish the two species; they are remarkably similar; the antennal scape in *reduvioli* bears the peculiar sculpture. The males of *enockii* differ from the males of *reduvioli* in having distinctly longer joints in the flagellum. The coloration of both species is the same. In regard to the North American *psecas*, the Hawaiian species, comparing the females first, differ thus: Only in the fact that the second funicle joint is shorter in relation to the first in the North American species, but in the same species I have seen a specimen where the two joints were subequal; this difference is certainly very small and it is extremely difficult to know what to do in such cases. By comparing the males, it is seen that they differ as in the case of *enockii*, the flagellar joints in *psecas* being distinctly longer. For the present, therefore, I leave the species separate, though they form suspicious units. In one specimen of *psecas*, the second funicle joint was yellow like the first.

On November 4, 1911, I captured a single female *Polynema* from a window around the veranda of a private residence at Kuranda, North Queensland, a locality a few miles distant from the nearest sugar-cane area. This species bore a long proximal funicle joint of the antenna and as expected closely resembled the foregoing species. I now compare it with them. It resembles all but more nearly *enockii* and *reduvioli*, differing from the former in bearing fore wings like the latter; thus, as concerns the antennæ, it is intermediate or nearly between *reduvioli* and *psecas*. From the Hawaiian species I am unable to separate it, so that the species is common to the Sandwich Islands and Australia. From what Perkins states in the original description of his species (*reduvioli*) I have not much doubt but what it is the same as *hawaiiensis* of Ashmead. In the Australian specimen of *reduvioli*, the proximal funicle joint was shorter than usual, but there seems to be considerable variation in this respect, as I have experienced with *psecas*. Hence, the English species is the most distinct, while the North American and Hawaiian forms are very closely allied if not the same.

Here we have specimens of at least two distinct species of *Polynema*, and probably three, occupying an enormous area of the

earth and occurring in very distant countries with greatly different climates; and the two or three are strikingly alike. The climate of North America is vastly different from that of Hawaii or North Queensland, and yet we find forms occurring in all three places that are so much alike as doubtfully representing two species. As concerns the occurrence of the Hawaiian form in Northeast Australia, the explanation again hinges upon commercial distribution, since the species is associated with sugarcane insects in Queensland and the Sandwich Islands. Commerce seems to be accomplishing in a few years what nature takes thousands to do.

I believe it is true in all genera that their species will be found to be more or less clustered in groups, and this seems to be necessary from their nature and the manner of their formation. These clusters of species must be viewed as genera in the making and although it must be conceded that natural genera occur, since it is allowed that species are natural, still from the standpoint of human experience and reason it is extremely difficult to say just where a genus commences and a cluster of allied species ends, just as it is difficult to say when a variety is a species. So we find it in this mymarid genus *Polynema*. There are species grouped according to the width of the fore wings, as *longipes* and its allies and the closely allied group of species including *consobrinum*, *striaticorne*, *regina*, and *euchariforme*. Enock separated one species characterized by a long proximal funicle joint in the antennæ as the distinct genus *Stephanodes;* subsequently other species were found bearing the same character, two or three of them much alike in coloration, the structure of the fore wings, and other appendages and agreeing also in bearing a peculiar sculpture on the scape. But one of them is totally different in the structure of the fore wings and in coloration, and in still other species the peculiar sculpture of the scape occurs without the other correlated characters. This species group seems to be more on the way toward forming a genus, but since it is difficult to say just what the characteristics of the genus will be if the group is raised to that rank, it seems best not to accept the genus. If the long proximal funicle joint is taken as the separating characteristic, with what is it correlated and how long it is necessary for it to be, the species *striaticorne* and *bifasciatipenne* form connecting links between the forms bearing a short proximal funicle joint and those bearing a long one, and although these species have the sculptured scape (only rarely in *striaticorne*), but totally different wings and color, where is the correlation demanded. There are no other characters available as a basis for separation.

The above comparative notes are based upon these specimens: *Polynema enockii* Girault—one male, one female mounted in

balsam, labeled "Burnham Beeches, Eng. 2.6.08, 23.7.08 (male); C. Waterhouse. *Polynema psecas* Girault—Three females (from Illinois, U. S. A., Urbana, April 22, 1909, J. D. Hood; Mattoon, July 16, 1910; from United States National Museum collection, no labels); one male, Mattoon, Illinois, U. S. A., July 16, 1910. *Polynema reduvioli* Perkins—two males, one female remounted from cards in xylol balsam, received from Mr. O. H. Swezey and labeled "Honolulu, Oahu, 7.22.07," males, and "Pahala, Hawaii, 12.2.05," the female. Also a female captured in North Queensland as above noted.

2. Polynema rubriventre Perkins.

Mr. Swezey sent me two females of this species collected December 5, 1907 (12–5–07) at Kaumuchona, Oahu, Sandwich Islands, by himself. The specimens were mounted on cards. In order to remount them, these latter were removed from the pin and placed into a vial containing ordinary water. After a short while they had become dissolved from the cards and by gently shaking the vial were made to float freely upon the water. With a camel's-hair brush they were removed and placed upon a slide, upon which, after draining them, they were run through absolute alcohol and chloroform in succession, draining after each operation. Then being floated in chloroform, they were without difficulty removed to a central drop of xylol-balsam, merely by transferring them on the end of an insect pin dipped into the balsam; the balsam was then covered with a cover-glass. Gentle heat was then applied, placing the cover in its place and removing air and the mount was complete. This operation has been described because of the ease and rapidity with which it is performed and also because the mounts are sufficient for the purposes for which intended and no injury is done to the specimens.

Perkins described this species from Oahu from an elevation of 1,500 feet and upward. It is not known to occur elsewhere than Oahu. Its original description agrees with the specimens before me. The characteristic black of the head and thorax and the ferruginous of the abdomen contrast; the legs are intense orange yellow; the valves of the ovipositor are exserted for a distance equal to the length of the distal funicle joint or about somewhat less than a fifth of the length of the abdomen and they are concolorous with the abdomen. The species is a large one, robust, with broad fore wings whose discal ciliation is dense and moderately long, not fine. The longest marginal cilia are only about a fourth the wings' greatest width; the fore wings are somewhat larger than those in the *sibylla* Girault and has distinctly shorter marginal cilia; the fore wings also are distinctly fumated along the distal half of that portion of the blade which is distad of the venation

especially centrally or in the midlongitudinal line; the second funicle joint is the longest joint of the funicle, the third joint also long, twice the length of the moderately slender first joint, which is slightly longer than the pedicel. The distal three joints are all distinctly longer than the proximal joint and all subequal; the scape is not sculptured nor asperate; the club is rather short, stout, ellipsoidal. Marginal vein broad and short. Posterior wings without noticeable midlongitudinal discal ciliation, their cephalic marginal cilia somewhat longer than usual, bearing two lines of discal ciliation along each margin. The species is distinct from any which I have seen, though its fore wings are somewhat like those of the North American *sibylla* and perhaps somewhat like the English *flavipes*, but not much. I have seen no Australian species like it, but I have only two species of the genus which are new species and which appear to be indigenous. The male has never been described.

3. Polynema terrestre Perkins.

Described also fom Oahu, Sandwich Islands. This is an enormous species of the genus, being noticeably more robust than the preceding species, *rubriventris*. Mr. Swezey sent me a pair mounted on cards, together with another male of the species mentioned below (*poeta* n. sp.) which was mixed in. The specimens were labeled "*Polynema terrestris* Perkins. Oahu, Kaumuchona, ♀. 12.5.07; Olympus, ♂, 11.21.09. O. H. S." Both specimens were from the island of Oahu.

The original description agrees with the specimens, excepting with the latter the tibiæ of all of the legs and the scape were more or less brown or dusky, the distal funicle joint (and the two preceding ones also) in the female distinctly more than thrice its width, at least five times longer than wide, the club distinctly less than the combined length of the two preceding joints; also, the longest marginal cilia of the fore-wings are distinctly less than half the greatest width of the large fore wings, not more than between a third and fourth as long as the wing is wide. The scape is without sculpture; funicle joints all moderately long, the second very long. The fore wings have a smoky line across them at the marginal vein; the latter is rather long. The fore wings are broad and large, larger than in *rubriventre*, their discal ciliation fine and dense, somewhat as is *reduvioli*, each cilium, however, rather long. The tarsi are noticeably clothed with stiff, short bristles. The cephalic marginal cilia of the posterior wings is distinctly longer than the blade is wide and at tip the blade bears several confused lines of discal ciliation in the midlongitudinal line. The original description of this species is certainly not very explicit and is nearly the same as for the species *gigas*. For all

one may know to the contrary *gigas* may be the same as *terrestris*, since all that we know about it is that the legs are more or less brownish or yellowish. Now species of the genus may easily vary that much, that is, from yellow to brown in the legs and basal antennal joints, and making species on such differences is hazardous, to say the least. Because of such tendency to vary, the descriptions become all the more obscure.

This species differs from any other species known to me, mostly in its enormous size, its large fore wings, which bear almost forty lines of discal ciliation across the wides point, and the long antennal joint, especially the second and third joints of the funicle. It is distinctly larger than *Cosmocomoidea morrilli* Howard, which is a large species for the family. The fore wings are much broader than those of the North American *graculus* and *sibylla*. From the European *flavipes* it differs again in its robustness in body and appendages. The joints of the flagellum in male *terrestris* shorten distad, but the proximal joint is somewhat shorter than the second joint, which is at least six times longer than broad. The shortening becomes noticeable as funicle joint 8. Joints finely striate.

The other male, which as stated was sent with *terrestre* as a specimen of that species, is quite distinct and appears to be undescribed. This case again illustrates how the members of this genus may be alike in color, yet different in structure, and also how careful we must be in dealing with these systematically difficult insects. I describe the species herewith.

4. Polynema poeta new species.

Male.—The same as *terrestre* male, excepting as follows: Decidedly smaller, slightly smaller than *rubriventre* but still large for the genus, measuring about 1.40 mm. The pedicel, scape, abdominal petiole and all of legs except the black distal tarsal joints, chrome yellow, the convex margin of the scape asperate slightly. Joints of the tarsi and of the flagellum all somewhat shorter than in *terrestre*. The fore wings are entirely different, except in the marginal vein. Thus, they are noticeably narrower though of the same shape, while the discal ciliation is coarser and less dense (only about twenty-six lines across the widest portion of the blade), the longest marginal cilia about slightly over a third of the fore wing's greatest width. The thorax apparently without sculpture, the parapsidal furrows distinct, curved, a transverse line of foveæ across the apex of the scutellum, near the margin. Joints of antennal funicle where longest (joints 2–5) at least six or more times longer than wide, the second somewhat longer than the first, which is subequal to joint 6; 7 somewhat shorter than 1, while joints 8–11 are subequal and only about four times longer than wide. The joints are longitudinally striate.

From a single specimen, 2–3 inch objective, 1-inch optic. Bausch & Lomb.

Female.—Not known.

Described from a single male specimen received from Mr. O. H. Swezey as above noted. The species is characterized by the shape, size and ciliation of the fore wings, which are broader than in most species of the genus, resembling those of *sibylla*, nearly, though the marginal cilia in that species are longer.

Habitat: Sandwich Islands—Oahu (Olympus).

Type: Cat. No. 15251, U. S. National Museum, Washington, D. C., the above male (mounted on a slide with a pair of *Polynema terrestre* Perkins).

5. Polynema tantalea Perkins.

The fourth species received from Mr. Swezey is native to the Sandwich Islands and was described form Oahu. It is a large species, but not so large as *terrestre*, to the naked eye appearing intermediate between that species and *rubriventre*. It is characterized as far as other species known to me are concerned by its ferruginous color and clear fore wings, the head black (sometimes in balsam having a metallic greenish tinge, though I doubt the realness of that) and the distal five antennal joints, the distal tarsal joint. I was sent two specimens, but they represent two apparent species, neither of which agree with the description of *tantalea*. A male specimen agrees, however, excepting that the abdomen is black only at tip. Here again is a case where it is impossible to identify with certainty the specimens from the descriptions, since no comparative descriptive notes are given for the species, more especially in regard to the fore wings in which these two species differ. I shall thus consider the male specimen as *tantalea*, since it agrees nearly with the description of that species (its abdomen is obscurely dusky nearly to base, black at tip); the female, however, appears to be undescribed; it differs from *apicalis* in having the third and fourth antennal joints yellow and the wings hyaline, from *perforator* presumably in bearing a shorter club, a shorter proximal funicle joint, shorter marginal cilia of the fore wing, and the yellow third and fourth antennal joints; and from *oahuensis*, a third similar species described by Perkins from Hawaii, in having the four distal joints of the antennæ black, the head all black and shorter marginal cilia of the fore wing. As regards *tantalea* as represented by the male specimen, it differs in having the fore wings less broad, the discal ciliation denser but of about the same quality; thus, the *tantalea* bears about thirty-four lines of the cilia across the widest blade portion, while the other bears about thirty denser lines. The difference is noticeable, but without more material I merely designate this

female specimen as a narrow-winged variety of *tantalea*. I do this with some diffidence, realizing the difficulties, but at the same time remembering that it is the business of systematic entomology to detect these differences and record and interpret them. The male specimen of *tantalea* has the distal joint of the flagellum somewhat shorter than the proximal funicle joint; the joints are finely, longitudinally striate; the line of foveæ on the scutellum is composed of two obliqued straight lines on each side of the meson, meeting at the meson. The line appears to be a broad, convex curve in the variety. In *tantalea* the length of the longest marginal cilia of the fore wing is equal to about a fourth of the wing's greatest width. The caudal marginal cilia of the posterior wing are very long, longer than the longest cilia of the fore wing. The forewings are broader than those of the North American *sibylla*, with shorter marginal fringes.

Polynema tantalea longipenne, new variety.

Female.—Ferruginous, the distal five antennal joints, the distal tarsal joint, the intermediate and posterior tibiæ, the basal portions of the cephalic tibiæ, the marginal vein, and the head black or blackish. Funicle joints 1 and 2 suffused with dusky. Fore wings slightly stained at the distal half of that portion of the blade distad of the venation. Proximal funicle joint subequal in length to the pedicel, not quite half the length of the second joint, which is a fourth longer than the third; funicle joints 4, 5, and 6 subequal, each a fourth shorter than the third and distinctly longer than the first, the club not quite equal in length to the two preceding joints combined. Fore wings nearly as in *Polynema sibylla*, but the marginal cilia are shorter.

Like *tantalea*, except as noted above in regard to its fore wings and probably the foveate line across the scutellum.

Described from a single female specimen received from Mr. Swezey and labeled "*Polynema tantalea* Perkins, Kaumuchona, Oahu, 12.5.07. O. H. S."

Habitat: Sandwich Islands, Oahu (Kaumuchona.)

Type: Cat. No. 15252, U. S. National Museum, Washington, D. C., one female in xylol-balsam (mounted with a male specimen of *tantalea*).

The foregoing male of *tantalea* was collected by Mr. Swezey at Tantalus, Oahu, October 15, 1911.

Thus we have seen four common species of *Polynema* indigenous to Hawaii which are distinct from native North American and Australian species of the genus, so far as is known; also from native European species of the genus so far as my limited knowledge of these latter goes. Also, it has been shown that there is a relation between the species so far known to exist in several continents

and the presence of commercial crop plants with which they have become associated. These facts bear out the conclusion long reached by naturalists that these widely distributed species must once have been confined to their place of origin in some one of the continents now occupied by them so recently.

I may add that *Dicopus psyche*, which I recently described from Fiji, has subsequently been found in North Queensland.

Meeting of November 7, 1912.

The 262d regular meeting of the Society was entertained by Prof. T. B. Symons and Mr. A. B. Gahan at the Saengerbund Hall, 314 C Street N. W., on the evening of November 7, 1912, and there were present: Messrs. Baker, Barber, Burgess, Busck, Caudell, Cory, Craighead, Crawford, Cushman, Duckett, Fisher, Gahan, Gill, Green, Heidemann, Heinrick, Hopkins, Howard, Johansen, Knab, McAtee, Marshall, Middleton, Myers, Quaintance, Rohwer, Russell, Sanford, Sasscer, Schwarz, Siegler, Snyder, Symons, Walton, and Wood, members and C. C. Craft, J. R. Malloch, and R. C. Shannon, visitors.

The following proposed at the 261st meeting of the Society were elected active members: C. T. Greene, Carl Heinrick, J. D. Hood, F. Johansen, and W. Middleton. In addition the following names were proposed for active membership: F. C. Craighead, A. B. Duckett, and W. S. Fisher. Under suspension of rules, the three were elected.

Under new business the Recording Secretary read the following proposed amendments to the constitution:

Article IV to be amended to read as follows:

The officers of the Society shall be a President, a First Vice-President, a Second Vice-President, a Recording Secretary, a Corresponding Secretary-Treasurer, and an Editor, to be elected by ballot at the annual meeting. There shall be an Executive Committee consisting of the officers of the Society and three members to be elected by the Society in the same manner and at the same time.

Article V to be amended as follows:

Section 4. The Editor shall edit the magazine published by the Society under the direction of the Executive Committee.

Section 5 to be the present Section 4.

Article III, Section 3, third paragraph to read as follows:

Honorary members shall be proposed only by the Executive Committee. They shall then be voted upon by all of the active members of the Society, the ballot being taken by mail, due notice of the Committee's nominations having been sent to each member. Ballots received later than 60 days after the mailing of the Committee notice shall not be counted. A unanimous vote of the Executive Committee shall be necessary to a proposal and a four-fifths vote of the active members casting ballots shall be required to elect.

The question of a seal for the Society was mentioned and it was moved and seconded that the Executive Committee take up the matter with power to act.

Under the title "Some recent Experiences in Europe" Dr. L. O. Howard spoke of his last summer's trip to England, France, Holland and Germany for the purpose of interviewing European shippers of nursery stock to America and the officials charged with the carrying out of the foreign inspection laws. He also spoke especially of the International Entomological Congress at Oxford and showed photographs he had taken of many of the European entomologists in attendance as well as of others he had visited on the continent.

The second paper was presented by Mr. W. R. Walton:

THE VARIATION OF STRUCTURAL CHARACTERS USED IN THE CLASSIFICATION OF SOME MUSCOIDEAN FLIES.

By W. R. Walton, *Bureau of Entomology.*

Since the publication of Baron Osten Sacken's admirable Essay of Comparative Chætotaxy[1] in 1881, the use of characteristic bristles as a means to the classification in the Cyclorapha has become general among dipterologists and has resulted as a whole to the great advantage of science. There must, however, exist a limit beyond which these chætophorous characters become unreliable, especially as a guide to specific values. So it has been with this idea in view and in hope of securing data regarding such limitations that these somewhat fragmentary studies have been undertaken whenever proper material and time permitted.

[1] Mitth. d. Münchener Entem. Vereins, vol. v, pp. 121–138. 1881.

Calliphora viridescens Desvoidy, a common blow fly referred by some authors to the family Muscidæ and by others to the Sarcophagidæ is a species known colorationally from its North American congeners by the black cheeks and beard, but structurally solely by the presence of a third pair of posterior intraalar bristles.

An opportunity of studying the relative constancy of this character was afforded during the year 1908 at Harrisburg, Pa., by rearing it in considerable numbers from the putrid body of a snake. No less than 540 full sized individuals, comprising three species, having been reared from the body of the reptile which in life, could not, have exceeded 24 inches in length.

Of the number mentioned above 247 proved to be *C. viridescens*. The entire series was examined individually and the results tabulated, they are as follows:

Number of specimens examined	247
Number of males examined	131
Number of females examined	116
Number of males abnormally bristled	20
Number of females abnormally bristled	32
Total number of abnormal specimens	52 or over 20 per cent
Number of males with supernumerary bristles	20
Number of females with supernumerary bristles	30
Number of females with less than 3 intraalars	2

In nearly all cases where supernumerary intraalar bristles occurred they were smaller than normal. In other words there was an apparent tendency of the most cephalad towards obsolescence. In several cases no less than five macrochætæ replaced the usual three, the more frequent number, however, was four and the aberration was bisymmetrical or otherwise. Two individuals possessed but a single pair of posterior intraalars on each side and could therefor not be distinguished structurally from *Calliphora erythrocephala*.

In no group of the Diptera have chætotactic characters proven of greater service than in that exceedingly large and homogeneous assemblage designated in the works of the more conservative authors as the family Tachinidæ.

Some nineteen years have elapsed since Dr. S. W. Williston[2] pointed out the remarkable structural variation to which the species *Belvosia bifasciata* Fabr. is subject. He remarked the variation in the ciliation of the fascialia, comparative length of the antennal joints, angularity of the fourth vein and in the male, of the length of the anterior claws. So it is perhaps not surprising that a corresponding variation is found in the number and arrangement of the macrochætæ particularly of the thoracic region, but also of the abdomen in this species.

[2] Insect Life, vol. v, p. 238.

The appended table has been constructed from ten specimens of the above mentioned species, ranging gradually from 12 to 19 mm. in length, measured from the outer edge of the front to tip of abdomen. These measurements probably represent the extremes of size in the species, although Mr. D. W. Coquillett[1] gives them as 13 to 17 mm.

In the existing synoptic tables, the branch of the dichotomy running out at *Belvosia* reads "Ocellar bristles wanting." By reference to the present analysis it will be seen that these bristles are present in five out of the ten specimens examined, in four of them only on one side of the head, in the remaining case bisymmetrically developed. When present they are directed forward, not strongly developed but perfectly distinct from the surrounding hairs with an ordinary hand lens.

In Mr. Coquillett's table of the genera, dichotomy 116, one branch of which runs to *Belvosia* we read "Second segment of abdomen never bearing more than four marginal macrochætæ." By the present analysis we see that they may vary from 2 to 6 and are asymmetrically placed in two out of ten cases.

Mr. Coquillett further says "Our species (of *Belvosia*) have four post sutural (dorso central) and four sterno pleural macrochaetæ." It will be seen that this occurs in only one-half the specimens examined. The fact is these macrochætæ are wofully variable in number, size and arrangement.[2]

A glance at our table shows that the marginal macrochætæ of the scutellum increase in number almost directly as the length and robustness of the body, in fact generally speaking the larger, stouter, and therefor more fully developed the specimen, the more numerous the macrochætæ become on all parts of the thorax.

Mr. C. H. T. Townsend[3] has said: "It has been alleged that much of the so-called synonymy in this superfamily, as it stands in the Aldrich Catalogue, is due to a misguided erection of species on stunted specimens developed from underfed larvæ, through a lack of acquaintance with the breeding habits of the species. It is well known to all students of the Muscoidea that the females sometimes, if not frequently, carry the act of oviposition to an extreme, ovipositing upon larvæ that are already overstocked with

[1] Revision of N. A. Tachinidæ, p. 84.

[2] The author wishes to disclaim most emphatically any intention or attempt to discredit this admirable and indispensable paper of Mr. D. W. Coquillett's. It is a pioneer work and necessarily not perfection. Mr. Coquillett was fully aware of the fact, and had he lived to complete his life work, it is altogether probable that a perfected revision of his paper which he contemplated would have eliminated any fault in the content of the original work.

[3] The Taxonomy of the Muscoidean Flies, Smithsonian Misc. Col. No. 1803, p. 19.

eggs. This has been observed and recorded in a number of instances. It has been observed at the Gipsy Moth Laboratory of the Bureau of Entomology in Massachusetts that tachinids would oviposit at times upon larvae covered with eggs, while masses of unstocked larvæ were abundant close by. . . . . Similar conditions could hardly arise except through man's interference. . . . . The stunted specimens always exhibit practically the same characters, and if there is any exception, the true status of a specimen is quite recognizable."

Specimen Nos. 1 and 2 are taken from a series of 14 reared from one pupa of *Basilona imperialis*. Furthermore it contained in addition to the 14 which emerged one dead Tachinid puparium and a shriveled larva, the puparia were crowded tightly together occupying every available space within the pupa shell. The larva of the host was collected from nature at Catawissa, Pennsylvania and sent to the Division of Zoology at Harrisburg, Pennsylvania, where H. O. Marsh made the rearing. *E. imperialis* is a native species and since there is practically never an abnormal plentitude of these large insects, at most, never so many as to upset the equilibrium of nature, it must be admitted, in the light of the facts noted below, that too many larvæ fed upon this individual, to permit of a full development of the resulting adults. There is no evidence here of "mans interference."

Specimen number seven was reared from a pupa of *B. imperialis* collected from nature as a larva at Rockville, Pennsylvania, by A. B. Champlain. It will be seen that it measures 4 mm. longer and is very much more heavily bristled than specimens number one and two. It was the sole inhabitant of the host pupa, which was rather a small one for the species. But that this Tachinid is capable of still further development is shown by the measurements and chætophorous adornments of examples 8, 9 and 10. So it may be assumed that had more food been available for specimen 7, further development would have resulted. In other words, it appears probable from the evidence here adduced that not only is the gradual increase in size due to increased food supply but the number and size of the macrochætæ increases almost directly with the size of the individual. Correlated with this is a gradually increasing brilliancy in color. The stunted specimens are pale, the golden bands of the abdomen are faded and the wings nearly hyaline, the squamæ dirty white. At the other extreme of size and chætophorous development, the colors are most brilliant, the bands of the abdomen are splendidly golden in contrast with the remainder of the abdomen which is intensely shining black, the eyes in life are purple and iridescent, the wings and squamæ are a very dark brown. Between these extremes there is a gradation of color. It may be seen from the foregoing

that the genus *Belvosia* as now known is based upon structural characters which are quite variable. Fortunately, that indescribable something which we call "habitus" is strongly in evidence in the genotype *B. fasciata*. But the question immediately arises; what about those genera and species of Muscoidea based almost entirely upon chætotactic characters and where habitus is weak?

In a series of 130 specimens of *Winthemia quadripustulata* reared from larvæ and pupæ of *Laphygma frugiperda* collected mainly on the grounds of the Department of Agriculture, Washington, D. C., during the month of September 1912, 9 specimens or about 7 per cent were found which cannot be properly placed specifically by the existing tables. Two group characters are used in these tables, one being the number of dorso central bristles, the other, the number of sterno pleurals. No variation was found in the number or arrangement of the former. In the latter, however, the number and also the arrangement was found to be variable to the extent noted above. Seven of the variants are males, five of them large specimens. The two females are smaller than average size. In the males the arrangement of the sterno pleurals giving the left side first is as follows:

	3 specimens 1–1, 1–2
	2 specimens 2–1, 2–1
	1 specimen 2–1, 1–1
In the females	1 specimen 1–2, 1–2
	1 specimen 2–1, 1–1
	1 specimen 1–1, 2–1

It will be seen from the foregoing that the variation is both symmetrical and otherwise in the series and that the supernumerary bristle may be placed either at the anterior or posterior corner of the sterno pleura. Thus the stability of this character in *Winthemia* is evidently far more absolute. There is also apparent in this series a considerable variation in the comparative lengths of the second and third antennal joints and in the width of the latter.

In justice to Mr. J. D. Tothill it should be stated here that an examination of the cotype material of his *Winthemia fumiferanæ* shows the species to be obviously distinct from *W. quadripustulata*, notwithstanding the above noted failure of the sterno pleural characters.

There is one other character used in connection with the Tachinidæ which needs careful investigation, namely, the hairiness of the eyes. In a series of 24 specimens, 12 males and 12 females, of *Myiophasiaænia* Wied. reared as parasites of *Chalcodermus æneus* Boh. by G. G. Ainslie of the U. S. Bureau of Entomology, at Clemson College, South Carolina, the males have hairy eyes

and the eyes of the females are bare. The amount of pilosity of the male eye varies.

Mr. C. H. T. Townsend[1] has erected the genus Ennyomma on a single male of this species because of the hairy eyes and has since declared[2] "The genus may be distinguished from both *Myiophasia* and *Phasioclista* by its thickly hairy eyes." The hairiness is variable and is a secondary sexual character at best; further comment is unnecessary. Few of us will be willing to assent with Mr. C. H. T. Townsend[3] that "these forms cannot be classified in the ordinary way . . . . . there is no such thing as a species in the generally accepted sense," and further "the only safe course to pursue is to give a name to every assemblage that can be distinguished from other assemblages." etc.

This sounds suspiciously like an acknowledgment of defeat. The Muscoidean flies are subject to the same general laws of development as all other insects and can probably be classified without erecting a new system of nomenclature.

Dr. S. W. Williston[4] has said "We yet know very little about individual variation in this family (Tachinidæ), or the real value of many characters now used. The absence or presence of a bristle may be found to represent a group or species, but we should first learn *how constant the character is in species.*"

Nineteen years have since elapsed and his statement still applies to the situation. The required knowledge cannot be obtained with a pen and a few dried specimens, though rivers of ink flow. Nor can the problem be solved by the use of the dissecting needle and a vivid imagination.

The patient study of specific variation in even a few of the most homogeneous groups will certainly throw considerable light on the subject and this method is perfectly practicable for any worker who has the opportunity of rearing tachinids in numbers.

As was acknowledged at the beginning of these remarks, the studies herewith included are but fragmentary in character, nevertheless, the evidence drawn from them points quite strongly toward several definite conclusions.

1. The chætotactic characters as at present used in the classification of Muscoids are variable to a considerable degree and should be tested whenever opportunity permits.

2. These characters are in some species subject to variation *with the fluctuation of food supply of the larva.* This phase of the question must be investigated in connection with any studies of specific variation.

[1] Trans. Amer. Ent. Soc., vol. XVIII, p. 370.
[2] Taxonomy of Muscoidaen Flies, p. 58.
[3] Taxonomy of the Muscoidean Flies, p. 13.
[4] Insect Life, vol. V, p. 238.

3. The hairiness of the eyes in some forms of Tachinidæ is a secondary sexual character and is therefor not available as a primary generic character, unless both sexes are known to the describer.

There are also certain other recommendations which could be adopted to advantage in the study of the Muscoidean flies, namely:

a. The erection of a genus on a single example of either sex is folly and should not be permitted.

b. The proposal of a new species on a single specimen or a series representing only one sex is inadvisable.

c. The creation of either a genus or species on solely chætotactic characters without a careful study of ample material is unwise.

d. The variants of a species should be conserved under one species name until good and sufficient evidence is adduced to prove they are otherwise. The splitting of species in the genus Lucilia[1] as practiced by Mr. Townsend is a negative example of what is here meant.

Analytical Table, Constructed on Ten Specimens of Belvosia Bifasciata, Showing Structural Variation.

	Ocellars		Dorsocentrals		Acrostichals		1st Abd. marginal		2d Abd. marginal		Marginal scutellars		Sternopleurals		Fascialia bristled on		Length body	Width abdomen	
	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right			
																	mm	*mm*	
1	0	1	4	4	4	4	1	1	1	1	4	4	4	4	½	½	12	5½	From series of 14 reared from a single larva of Eacles imperialis, Catawissa, Pa.
2	0	0	4	1	3	4	1	1	1	1	4	4	4	4	½	⅔	13	6	
3	0	0	4	4	4	4	1	1	1	1	5	4	4	4	½	⅔	13	6	Collected, Hertford, N. C.
4	0	0	4	4	4	4	1	1	1	1	4	4	4	3	⅔	¾	14	6½	Collected, Hertford, N. C.
5	0	0	4	4	4	4	1	1	1	1	5	5	4	4	⅔	⅔	15½	7	Collected, Hertford N. C.
6	1	0	5	1	5	4	1	1	1	1	5	5	4	5	⅔	¾	15½		Collected, Anacostia, D. C.
7	0	0	5	6	5	5	3	2	3	3	8	6	6	6	⅔	¾	16	8	Reared from larva of Eacles imperialis, Rockville, Pa.
8	1	1	6	6	4	4	3	3	3	2	8	6	7	7	⅔	⅔	18	9	Collected, Harrisburg, Pa.
9	1	0	5	5	5	5	3	2	2	3	6	6	6	5	½	⅔	18	9	Collected, Harrisburg, Pa.
10	1	0	5	5	7	9	3	3	3	3	6	5	6	5	⅔	¾	19	9	Collected, Inglenook, Pa.

[1] Taxonomy of the Muscoidean Flies, pp. 118–123.

It seems possible that the studies of the internal anatomy of these flies upon which Mr. C. H. T. Townsend is at present working may eventually prove useful as an index to group relations. But the mass of undigested facts, near facts and conjecture with which he is at present deluging the devoted heads of his confrères will require an immense amount of elucidation, rearrangement and generous elimination before becoming available for use.

To conclude, there is great need of careful rearings of species belonging to homogeneous groups, from known parents, for the purpose of studying variation of structure, color and size within the species and, failing which our knowledge of the true relations of the Muscoidean flies will never extend much beyond its present meager limits.

In discussion, Mr. Malloch said that the tendency towards variation in the number of macrochætæ in Diptera is more pronounced in the higher groups, such as the Anthomyidæ and Tachinidæ, where the number of those macrochætæ is much larger than in the other groups such as the Tetanoceridæ, Ortalidæ and Phoridæ. In those groups with a few thoracic, or leg macrochætæ there is but little tendency to variation, and as a rule their number and situation is remarkably constant. When any duplication such as in the frontal bristles, occurs in the Acalyptrate Muscidæ, it is the almost invariable rule that the normal bristle is reduced in size and moved from its usual position. When variation, either duplication or reduction, in the number of macrochætæ occurs it is almost impossible to place species of Tachinidæ by using the tables of genera in the published works on the family. Too much weight has been placed on the length of the third antennal joint as compared with the length of the second. This also is a character that is prone to vary, as is also the length of the hairs on the arista. The hairs on the eyes, while under normal conditions easily discernible, in many species in the males, are most difficult to detect in the females of the same species. This applies not only to the Tachinidæ, but also to the Anthomyidæ, in which family far too much use has been made of this character in generic tables. In the latter family the generic tables in Williston's Manual are of little use for the identification of some groups. About one-half of the species in *Fannia* (*Homalomyia*), for exam-

ple, cannot be relegated to their proper position, because the calyptra are not noticeably dissimilar in size as required by the table. In examining large numbers of Diptera during the last 10 years, submitted form various Institutions and individuals in England and Scotland, it has been impressed upon me that the more macrochætæ a species has the more prone they are to vary in number and strength, and the larger the number of veins, such as in the Therevidæ, Tipulidæ and Asilidæ, the more variation there is in the number and course of those veins. It is rarely the case in species without recurrent veins that there is much variation, though I have seen several specimens, probably about half a dozen, out of about 7000 or 8000 Phloridæ examined in which abruptly terminated, instead of complete, veins occurred, or in which a small appendiculate vein was present, or a fork absent. In such cases only a thorough knowledge of the group will give one the necessary basis for identification. Arbitrary tables fail with abnormal specimens in any order, and the general habitus of the insect coupled with special knowledge must necessarily serve for identification purposes.

Mr. Schwarz remarked that in Coleoptera macrochætæ are to be found in many parts of the body and are successfully used as specific characters especially in Carabidæ and Staphylinidæ. As far as the North American fauna is concerned, Dr. Leconte was the first to call attention to their importance. In many instances the macrochætæ are lost but the pores remain and are remarkably constant in their position, for instance in the genus *Platynus*. They do not seem to occur in the large phytophagous families, at least not in the imago stage, unless we consider the sensitive hairs on the antennæ of certain Cerambycidæ and Rhynchophora as macrochætæ.

The third paper on the program was read by Mr. Thomas E. Snyder:

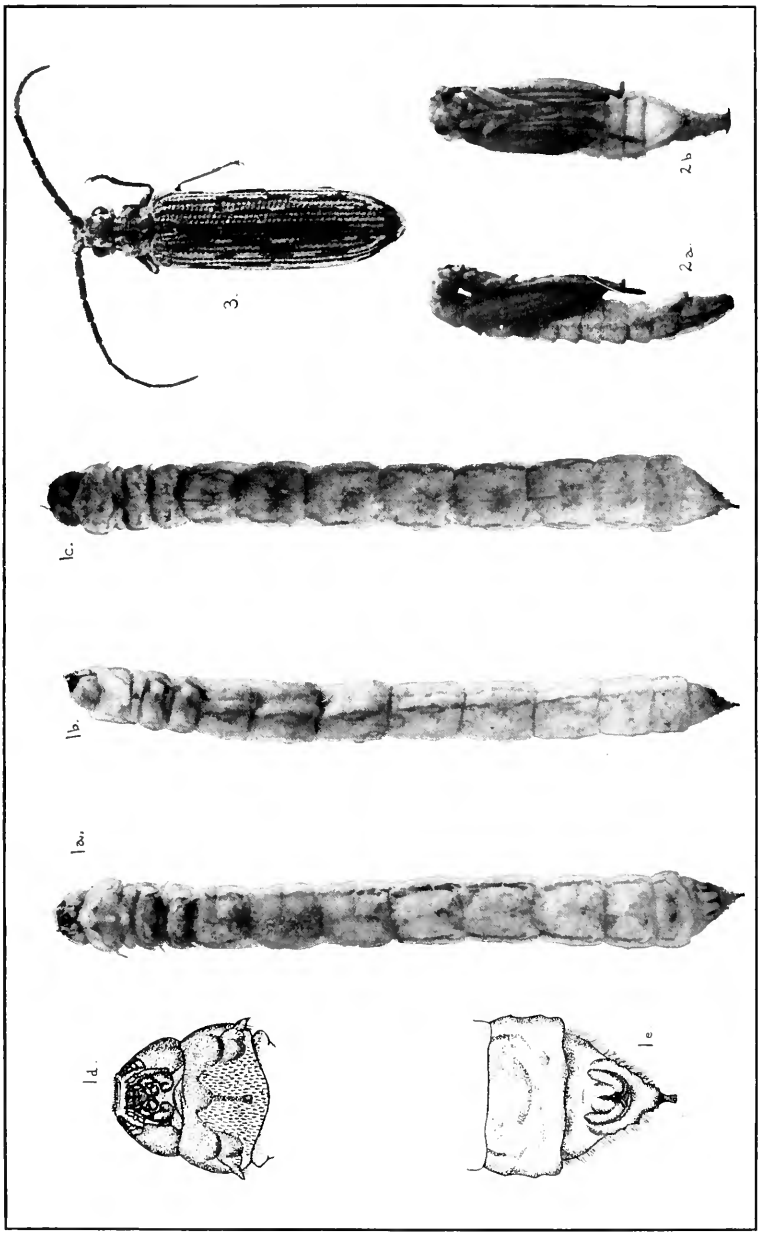
RECORD OF THE REARING OF CUPES CONCOLOR WESTW. (Coleoptera.)

By Thomas E. Snyder, *Bureau of Entomology.*

The position of the family Cupesidæ in the classification of Coleoptera has long been of interest to the systematist. So far as is known there are but meagre descriptions of the habits of these beetles and no figures of the larvæ exist. The larvæ of *C. concolor* are wood-borers, excavating longitudinal burrows in solid but decaying chestnut and oak wood; the burrows are packed with fine, digested boring dust. The pupal cells are cylindrical with rounded ends. Larvæ were first taken from the solid but decaying wood of the butt of a chestnut telegraph pole near Boykins, Virginia, on August 9, 1910, but remained unidentified. The pole had been broken off during a storm and reset sometime previous and the butt was lying on the ground. On May 1, 1912, numerous larvæ were found in the wood of a solid but decaying oak log lying in the woods near East Falls Church, Virginia. Some larvæ were in the prepupal stage. On May 22, one larva was found to have pupated since the preceding day. The pupa had transformed to a living adult sometime before June 6 on which date the adult was mature and another larva was found to have pupated. A third larva pupated on June 20 (since June 19). On September 17, 1912, similar larvæ were found in the decaying wood of a black oak stump near Elkmont, Tennessee, in the outer layers of wood but have not yet transformed. Burrows of the larvæ have been found in old, oak trestle timbers.

The larva figured is 23.5 mm. in length, white, elongate and sub-cylindrical. Body gradually broadening from the sixth to the eighth abdominal segment, ninth abdominal segment conical, with numerous long hairs on sides, armed with more heavily chitenized sharp tubercles, being produced to a narrow, heavily chitenized, cylindrical anal process; anal process widening at apex, tip concave. Pleural ridge on all abdominal segments. Prothorax prominent, approaching the characteristic dilation of *Eupsalis* and Lymexilonid larvae, broader than head and other thoracic segments. Prosternum broad, flat, armed with numerous chitenized asperities. Legs 5-jointed excluding claw; first joint large, flattened, fleshy lobe. Labium with hairs on anterior portion. Antennae 4-jointed. Maxillae with all three parts distinct; lacinia thick and fleshy, with long hairs pointing inward on anterior portion, palpi 3-jointed; galea 2-jointed. Labium black, chitenous, chisel-edged emarginate, with 2-jointed palpi. Mandible black, chitenous with large, blunt basal tooth and 3 other teeth.

Pupa figured is 11.5 mm. in length, white, body somewhat flattened, abdominal segments gradually broadening; anal segment widest, conical;



CUPES CONCOLOR WESTWOOD

genitalia with 2 lateral, curved, chitenous hooks, pointing anteriorally. Dorsal carina running the whole length of the body, becoming more distinct toward the end of the abdomen. Antennae lying ventrally, overlapping the elytra. Head bent ventrally at right angles to prothorax. First pair of legs lying between other pairs.

Explanation of Plate I

Cupes concolor Westw.

Fig. 1. *Larva* (23.5 mm.). (a) ventral view, (b) lateral, (c) dorsal, (d) mouth parts, ventral view, (e) anal segment, ventral view.

Fig. 2. *Pupa* (11.5 mm.). Note last two joints of the left antennae of pupa figured are deformed. (a) lateral view, (b) ventral view.

Fig. 3. *Adult*

Photographs by H. S. Barber. Drawings by C. T. Greene.

OBSERVATIONS ON THE LIFE HISTORY OF MICROMALTHUS DEBILIS LEC.

(Coleoptera.)

By Herbert S. Barber,
(Bureau of Entomology.)

In February, 1911, Mr. T. E. Snyder of the Bureau of Entomology, brought me for determination, some minute larvæ he had found in the buried end of a chestnut telegraph pole in this city. They were utterly strange to me but by chance the almost forgotten plate (here reproduced) of Micromalthus by the late Mr. H. G. Hubbard,[1] the first figures published by him, came to mind and the details there shown agreed so exactly with the fresh larvæ, that the determination was considered positive.

The history of our knowledge of this beetle is interesting. In August 1874, Messrs. Hubbard and Schwarz found a colony of larvæ, pupæ and teneral imagoes in a red-rotten oak log near Detroit, Michigan. They sent specimens to Dr. LeConte, whose description of the new genus and species, placed tentatively in the Lymexylidæ, appeared in their "Coleoptera of Michigan"[2] with Hubbard's description and plate of figures appended at LeConte's request. Its assignment to the Lymexylidæ was decided upon after correspondence between LeConte and Hubbard, the latter having found some points of similarity in the larvæ of *Hylocatus*.

[1] Proc. Amer. Philos. Soc., xvii, 1878, pp. 666–668 pl. xv.
[2] l. c., p. 613.

I do not know of another published reference to the beetle, except the checklist inclusion of the name, and Blatchley's[1] reference to the original capture by Hubbard and Schwarz.

In August of about 1882 or 1883, a flying adult lit on Mr. Schwarz's newspaper while he was reading in front of Professor Riley's house (on R st., near 13th, this city), and was immediately saved for the collection. Twenty years later (August 9, 1902) one alighted on my shirt while I was riding with Mr. Schwarz one warm afternoon on the Cabin John Car, just outside the District. This remained unique in my experience for nine years, until Mr. Snyder's larvæ were identified. Mr. Charles Dury writes that on August 9, 1911, one lit on his paper at dusk in Cincinnati, Ohio, this being his only experience with the species.

Mr. Snyder has found the larvæ occasionally since, and has kindly furnished the following locality and host-plant records. The first colony found extended 2 or 3 feet below the brick sidewalk in the base of a chestnut telegraph pole (on 9th Street near "P" Street N. W. Washington, D. C., February 3, 1911), the larvæ making shallow longitudinal burrows filled with fine, boring dust in the porous layer between the harder layers of annual growth. These burrows occurred only in the moist outer layers of the wood which had reached the red stage of decay. A second colony was found at East Falls Church, Virginia, March 18, 1912, in the moist outer layers of a decaying chestnut log and, in the jar of this material kept for rearing, a winged adult was found alive on July 20, 1912. Another colony was found near the same locality, on June 4, 1912, living in a chestnut stump; and a yellow pine log at Natural Bridge, Kentucky, (September 6, 1912) contained a very numerous colony of larvæ in the rotting, softer parts between the more resinous annual rings.[2]

[1] Coleopt. of Indiana, 1910, p. 895.

[2] Subsequent to the presentation of this paper, the breeding cell of this material disclosed on February 8, 1913, a few little, legged larvæ and when the rotten wood was broken up it was found that the colony was apparently just coming to maturity. Several specimens of the reproductive form were isolated, one of which began giving birth to young almost immediately (tail first and active, but becoming quiescent for a time afterward). Another, much shrunken, was with her nine young in her cell. Another cell contained twenty-one young but the mother could not be found. Two others of the reproductive form show the mandibles and anal armature of the unborn embryos through the dorsal integument,—fourteen in one, eight in the other. A number of mature larvæ in various stages between the still feeding, dark-colored specimens (having the alimentary tract distended with food), up through the slow process of preparation for moulting, into the white reproductive form were found and isolated. Isolations of the progeny have been made in the hope of ultimately getting the winged adults of both sexes. It is sincerely hoped that someone will secure the missing links in the life cycle and also determine the factors controlling the development

One day last August (1912), Mr. Snyder remarked that a certain old chestnut log on Plummer's Island, Maryland, looked right for them, and in a few minutes showed me a colony there. Since then I also, have been able to find them, for these larvæ seem to occur in almost any old red-rotten or yellowish-brown decaying oak or chestnut log, lying in the woods along the Potomac, but the original capture by Hubbard and Schwarz, i.e. the occurrence in one colony of numerous larvæ, pupæ, pædogenetic reproductive form and winged adults ready for issuance, does not seem to have been duplicated.

My first suspicion that we were dealing with a really remarkable case, came while looking at one of the vials of material that Mr. Snyder wished identified. This contained three forms of larvæ, but the idea of identity was so improbable, that its expression then would have seemed out of place. In addition to the normal legless larva figured and described by Hubbard, there was a form about one-half its length, similar in head and anal appendages and furnished with long, slender, weak legs which are most remarkable in the chitinized elongate tarsus, bearing two claws (see plate III, fig. 2*b*). The third form was more robust than the normal larva and seemed to be almost free from segmentation; the whole body being soft and formless, the head indistinct, soft and white, except the tips of the mandibles; the tail devoid of the chitinous armature, but terminating in a blunt, transverse carina. It was thought for a time, to be some obscure Dipterous larva, but some resemblance in the contour of the head, and its repeated occurrence with *Micromalthus* larvæ, suggested the possibility of its being a prepupa.

This hypothesis was shattered one afternoon at Plummer's Island, when embryos began issueing alive, but in an oval shape, from the ventral surface, close to the tip of the body of one that had shortly before been isolated in a small vial. I watched two issue, but my field lens was too weak, and more urgent work pressing. Next morning there were seven young legged larvæ crawling about in the vial, while the mother was somewhat shrunken and remained inactive. Lateral and ventral views of this specimen are shown on plate III, figures 1, 1a. while figure 2

of the pædogenetic or sexed broods. Perhaps it may be merely a change in temperature due to exposure of the log to sunshine, or food modified by the growth of other organisms or ferments in the rotten wood. Mr. Schwarz recalls that the original capture was in a large log in an open space in a swamp and that the sun shone freely upon the log, while the adult reared by Mr. Snyder was from a log on an open, sunny hillside. It seems imperative that we secure the sexed adults, particularly the egg-laying female and determine if the young larvæ hatching from her eggs are identical with the young legged larvæ here shown.

is one of her young. Thinking she might give birth to more, she was kept in a hollowed, split chip, with some of her young, but she rotted suddenly about a week later, and her young had disappeared in the wood. Two other isolations of this sort yielded respectively, three and five, legged larvæ from the supposed prepupal form, and these legged larvæ crawled into the pores of the wood, fed, lost their legs, and became the normal larva of Hubbard. These larvæ appear to be remarkably slow in their growth, four months (August to December) showing but slight increase in the size of young specimens in captivity. It is impossible to say at present, what substance in the rotting wood furnishes their nutriment. Often the young larva is found following one of the comparatively large pores of the oak wood, leaving the hole behind it plugged with fine particles from the walls of the pore which seems to be only very slightly enlarged, only the tyloses appearing to have been eaten. After the newborn, legged larva had been left a few hours in the crevice of a chip, the alimentary canal could be seen to contain minute quantities of food, of a brown color like the decayed wood.

An examination of Hubbard's alcoholic material discloses several specimens of the reproductive form, some of which contain embryos, while others had given birth to their progeny. A single specimen of the normal tailed and legless form of larva, is remarkable in that the body contents has separated into oblong oval bodies, assuming the appearance of the embryos in the reproductive form. This may be accidental or it may be significant. In another vial are numerous pupæ some of which seem to support the idea of the occurrence of winged adults of both sexes, but as they have been in alcohol for nearly forty years their condition is not the best. No sexual differences are observable among the few winged adults still preserved in the collection. These are thought to be males although the anal structures, seen in cleared slides, are not comparable with the genitalia of any beetle known to me.[1]

[1] A specimen was sent to Mr. Fredk. Muir of Honolulu, who, with Dr. David Sharp has just published an extended paper on the male genitalia of beetles (Trans. Ent. Soc., London, 1912, pp. 477–642, plates XLII–LXXVIII) and his reply seems to leave the sex still more uncertain. He writes, "I should have pronounced it a female. There is no *definite male* organ, and the only way to settle the point definitely is by dissection of the body of a fresh specimen for the testes or ovarian tubes. If this be a male then the only form I can associate it with is *Cyphon*, and *Microcara*, a group which Sharp and I have not yet been able to connect with any other form, or even to associate together with any certainty. *Microcalibius may* be somewhat like *Cyphon*. I am here only judging by the ædeagus and not by any other external structure."

It would be out of place now, to formulate a definite explanation of the unusual life cycle, that is here apparant, and which may be summarized, as far as has been observed, into the five stages: (1) viviparous, larviform, reproductive stage, in cell in wood, giving birth to (2) legged larvæ, which crawl into pores of the wood, feed, and moult becoming, (3) the legless larvæ described and figured by Hubbard, and from which it is believed either the reproductive form (1) or (4) the pupæ of, (5) the winged adults are derived.

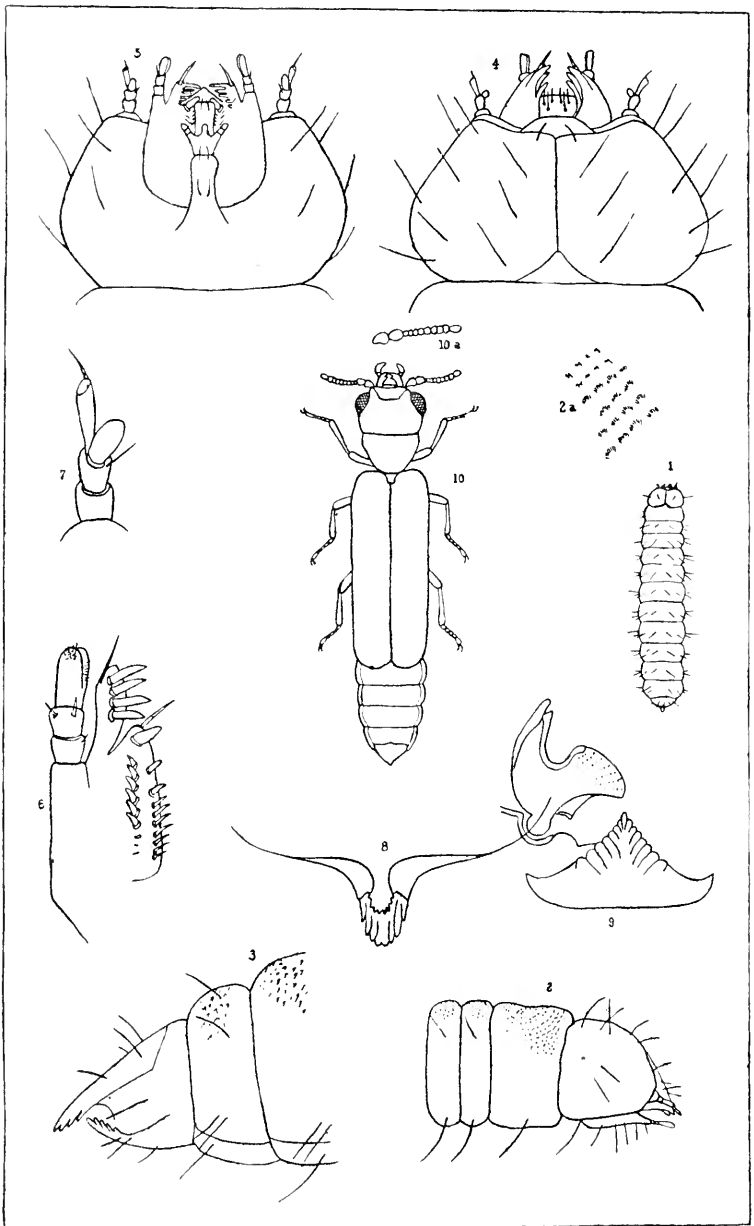
We may have here merely a case of extreme sexual dimorphism, as in *Phengodes*, which lay eggs or the Strepsiptera, which are viviparous, but if so, how is the fertilization of the helpless, reproductive form in the cell of the wood, often some distance underground, accomplished, and how can a new colony become established in a fresh log? There must be a migratory stage, more capable of travel than the crawling first larval stage. Perhaps a winged, egg-laying female will be found, proving the birth of the legged larvæ, from the degraded mother, to be pædogenesis, similar to that found in *Miastor*. The well-known agamic, viviparous reproduction of the Aphids may be considered a peculiar case of pædogenesis in which the young, being of the form of the adult may acquire wings or other adult characteristics, although they still remain essentially larvæ, the males and egg-laying females being regarded as the only really adult individuals.

The comprehensive article on viviparous and ovo-viviparous reproduction in the Chrysomelid genus Orina, by Champion and Chapman[1] brings together the literature on viviparity in beetles. The first mention seems to be Schiodete's account of the finding of well-formed larvæ, in the dilated abdomen of the very remarkable temitophilous Staphylinid, *Corotoca*. It is unfortunate that this paper has been followed by a period of sixty years in which, apparently, no corroborative observations have been made on these beetles which Professor Reinhardt found with certainty in every tree-nest of termites examined in the vicinity of Lagoa Santa, Minas Geraes, Brazil.

For the present the genus should stand alone in our classification, probably representing a distinct family, but it is not improbable, that some of the obscurely treated exotic genera of the Malacodermata, will be found to be allied to it. The possible relationship to the the Nitidulidæ, is suggested by the supplementary third antennal joint of the larva and is somewhat supported by the habitus of the adult.

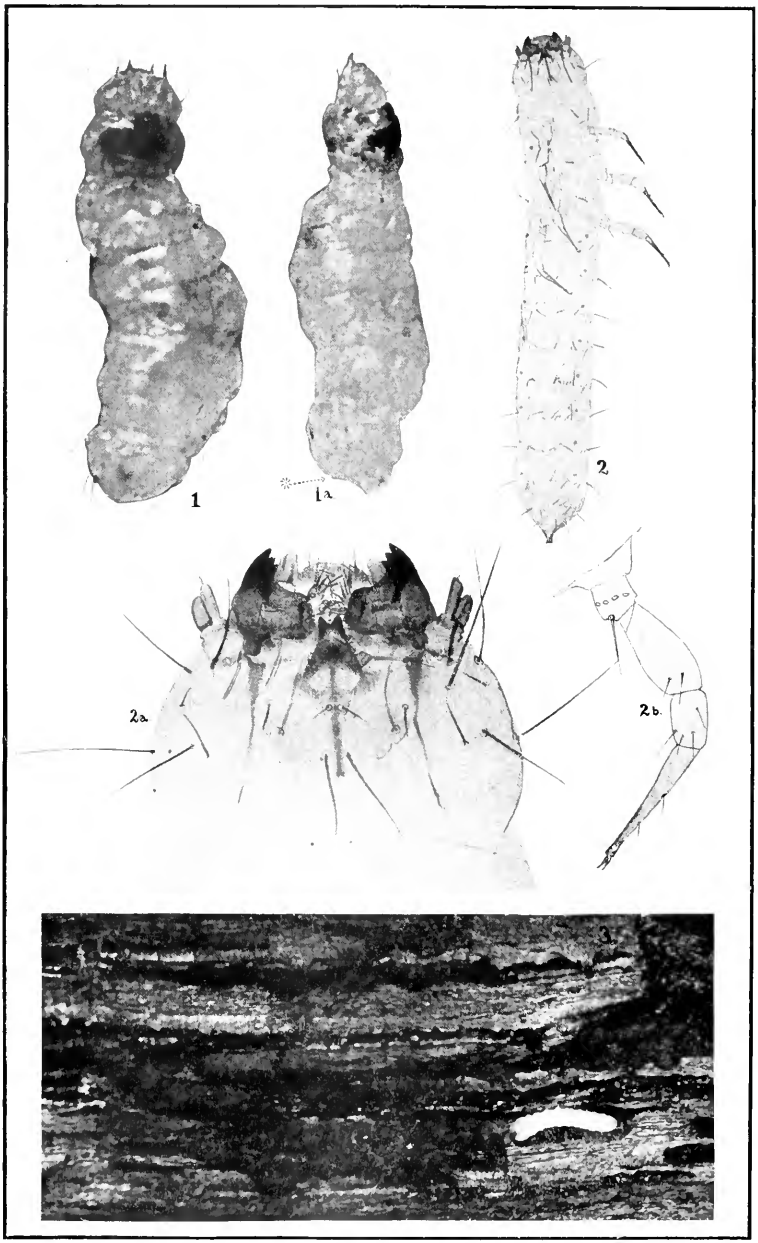
[1] Tr. Ent. Soc., London, 1901, pp. 1–18 plates I and II

[2] Vid. Selsk. Skr. 5R. naturo. og math. Afd. IV, B–1854, author's separate, pp. 14–17, plate I.



H G Hubbard. del.

Micromalthus debilis Lec. and larva.



MICROMALTHUS DEBILIS LECONTE

The genus *Telegeusis* described by Horn[1], as belonging in the Drilidæ, shows some points of similarity, but the differences in venation, and genital organs are too fundamental, it appears, to allow their close association in the classification. Closer comparisons should, however, be made of *Telegeusis* and *Atractocerus* to determine the assignment of the former to the Lymexylonidæ[2]

The importance of these observations was recognized so late in the season that the writer failed to collect sufficient material to permit the dissection of the reproductive form, and on account of ill luck and difficulty in the breeding, many of the larvæ kept under observation have died. Lest some unforseen changes make it impossible to carry on further observations during the coming season, it is thought best to make the data so far secured available to those who may be better prepared to work out the complete life cycle and to make the important histological studies.

Explanation of Plates

Plate 2. Reproduced from Hubbard[3]

Fig. 1. *Micromalthus debilis* Lec., larva enlarged twelve times.
Fig. 2. Head and thoracic segments, lateral view; much enlarged.
Fig. 3. Terminal segments showing the anal appendages, lateral view.
Fig. 4. Head from above, very much enlarged.
Fig. 5. Head from below, with mandibles omitted.
Fig. 6. Right maxilla, seen from below.
Fig. 7. Right antenna seen from below.
Fig. 8. Anal appendages, seen from below, very much enlarged.
Fig. 9. Corneous triangular piece lying above the mentum, with the left mandible thrown back, seen from above; the ridges upon the under surface of the mandible are indicated by dotted lines.
Fig. 10. Imago.

Note: For the sake of distinctness, the appendages in fig. 3 are drawn too large in proportion to the segments. The proportions are more correctly given in figures 1 and 8.

Plate 3.

Figs. 1, 1a. Dorsal and lateral photos of reproductive form after it had given birth to seven young. Length about 3 mm. Thoracic segments con-

[1] Proc. Cal. Acad. Sci., vol. v, 1895, p. 242, plate xx.
[2] Since the above was written a specimen of *Telegeusis* was sent to Mr. F. Muir of Honolulu, who has kindly examined its genitalia and reports it to be a typical Lymexylonid approaching nearest to *Atractocerus africanus*.
[3] Proc. Amer. Philos. So., 1878, vol. xvii, p. xv.

tain irregular mass of dark foreign matter. Asterisk (*) indicates point whence the embryos issued.

Fig. 2. One of the legged larvæ borne by No. 1, much more enlarged. Length, distended, about 1.7 mm. 2a, head greatly magnified; 2b, sketch of hind leg, showing the two claws at tip of the chitinized tarsus.

Fig. 3. Larva, nearly full grown, in its gallery; much enlarged. Length about 4 mm.

IDENTITY OF SCOTIONEURUS STENOSTIGMA PROV.

By A. B. Gahan.

Through the courtesy of Rev. V. A. Huard of the Provincial Museum, Quebec, it has been the writer's privilege recently to examine the type of *Scotioneurus stenostigma* Prov. The genus was erected by Provancher (1886) for the reception of two supposed species of Aphidiinæ. One of these species, *S. dives*, was afterward found by its author to be the male of his previously (by pagination) described *Ephedrus incompletus*. In recording this fact Provancher (1888) whether intentionally or not, transferred the species to the genus *Scotioneurus*, notwithstanding it is plainly an *Ephedrus* and it has been so recognized by several writers since Provancher, [Urich (1893), Hopkins (1898), Gahan (1910 and 1011)].

The identity of the other species, *S. stenostigma*, which must be considered the type of the genus, has remained more or less of a mystery. Dr. Ashmead (1901) regarded the genus as a synonym of *Ephedrus* and in this he was followed by Szepligeti (1904) who indicated by a question mark his doubt as to the correctness of this conclusion.

In a revision of the Aphidiinæ of North America, the present writer (1911) made the following statement with reference to the species in question. "The type of *Scotioneurus stenostigma* has not been examined but judged by the figure of the wing given by the author it is believed not to belong to this group." This in effect left the genus and species unplaced in the classification.

It is with considerable satisfaction, therefore, that I am now able to state definitely that the species is not an Aphidiinæ but that it belongs in the Alysiidæ. Unfortunately the antennæ of the type specimen are missing, making exact determination difficult but it apparently runs to the genus *Aspilota* in Foerster's table of the Alysiidæ and is congeneric with specimens placed in that genus in the collection of the United States National Museum.

A description drawn from the type follows:

Aspilota stenostigma Provancher.

Scotioneurus steonstigma Prov., Add. Faun. Canad. Hym., 1886, p. 157.

Female.—Length 1.6 mm. Antennæ broken. Head transverse, the occiput, vertex, frons and temples smooth and polished with scarcely any pubescence; occiput concave; temples broad, about as wide as the eyes; the vertex is divided by a shallow median longitudinal furrow; as viewed from in front the head is shorter than wide, the face below the antennæ smooth and covered with rather long hairs; eyes elliptical; cheeks short, clypeus prominent, its anterior margin convexly rounded, impunctate; mandibles tridentate, the median tooth slightly longer and more acute than the two lateral; viewed from the side the face is slightly convex below the antennæ.

Mesonotum smooth, polished, with sparse hairs, the parapsidal furrows absent on the posterior two-thirds, slightly impressed anteriorly; a short, shallow, longitudinal impression on the median line of the mesoscutum just before the scutellar fovea; scutellum smooth, polished, the scutellar fovea large and deep; mesopleuræ smooth, polished, with a short longitudinal more or less oblique crenulate furrow near the middle. Propodeum obliquely truncate, with a short median longitudinal carina anteriorly before the truncation, finely rugulose, the spiracles distinct, though not large; metapleuræ nearly smooth.

Wings hyaline, the stigma linear, scarcely wider than the postmarginal (metacarp) vein which is thickened slightly throughout its length; radial cell reaching to the wing apex, first cubital cell small, separated from the first discoidal and from the second cubital; second abscissa of radius more than twice as long as the first transverse cubitus, and nearly four times as long as the first abscissa; third abscissa of radius more than twice as long as the second abscissa: recurrent nervure joining the second cubital cell at an angle with cubitus so that the second cubital is five-sided.

Abdomen about as long as the head and thorax, petiolate, compressed into a sharp keel ventrally and at the apex; its first segment slightly wider at the apex than at base, two and one-half times as long as wide, regulose; following segments smooth and shining: ovipositor exserted about half the length of the abdomen and upward curved.

Color—Scape, pedicel, palpi, mandibles toward the tips and legs stramineous; head and thorax brownish black; pleuræ, propodeum and abdomen except ventral segments one and two more or less piceus, nearly black; tegulæ, wing veins and stigma yellowish brown, the stigma and marginal veins slightly darker than the others: ventral segments one and two more or less stramineous; ovipositor sheaths piceus.

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CHANGES IN THE MOSQUITO-FAUNA OF PANAMA.

By Frederick Knab, *Bureau of Entomology.*

That the changes in the physical features of the Panama Canal Zone brought about in the course of constructing the interoceanic canal would have a marked effect upon the life of the region has been repeatedly pointed out. It is unfortunate that no thorough study of the Panama fauna was made before radical changes in the character of the country had been brought about, so that their effect on its animal life might be determined.

The aquatic forms are the ones that must be particularly affected by the topographic changes in the Canal Zone. Streams have been changed in their courses, swamps have been drained and new bodies of water created. The mosquito life of the Canal Zone, with its many species (considerably over 100 are known from the region) and great diversity of breeding habits, must be particularly affected by these changes. Many species of peculiar habits, such as the many forms breeding in the water between

the leaves of various water-bearing plants, or in water in hollow trees and bamboo stumps, must have been eliminated with the clearing away of the forest. Others, particularly those breeding in smaller pools, undoubtedly have found increased opportunities for breeding within the zone of operations and multiplied proportionately—at least at times and in places. These opportunities for breeding must have fluctuated greatly with the progress of the work, involving as it does the constant creation of new breeding-places and their elimination or control. If it were possible to make a comparative study of the mosquitoes now existing on the Canal Zone with those found by Messrs. Busck and Jennings a few years ago, considerable changes could probably be shown to have occurred.

Imperfect as our information is, I have data which show that such changes have actually occurred. It would seem that with the creation of Gatun Lake a new element has been introduced into the mosquito fauna, or at least brought into prominence. Among the most important, considered as an annoyance, of tropical American mosquitoes, are the members of the genus *Mansonia*. *M. titillans* particularly is very widely distributed, occurring from Argentina to southern Florida, and is an aggressive biter. It is locally sometimes very abundant and troublesome. In working over the mosquito material from the Canal Zone collected by Messrs. Busck and Jennings from 1907 on, the absence of this characteristic species was most striking. Mr. Busck reported it from only one locality, Lion Hill, and Mr. Jennings did not send it in at all. Of a related species, *Mansonia fasciolata*, Mr. Busck obtained only a single specimen in the Zone, also at Lion Hill.

Another characteristic tropical mosquito of very wide distribution appeared to be absent from the Zone altogether. This is *Aedeomyia squamipennis* which ranges from Cuba to Argentina. Like *Mansonia titillans*, it is local and this local restriction only became comprehensible when the larvæ of the two species were found by Mr. H. W. B. Moore of Georgetown, British Guiana. The larvæ of both *Mansonia titillans* and *Aedeomyia squamipennis* occur associated with the aquatic plant *Pistia* belonging to the Araceæ. This plant floats in shallow water, its leaves spreading out at the surface, and to its roots the *Mansonia* larvæ are attached, extracting their supply of air from them. Just how intimate the association is in the case of *Aedeomyia* we do not yet know.

In lots of mosquitoes, taken recently and sent for determination by Mr. James Zetek, the entomologist of the Canal Zone, both *Mansonia titillans* and *Aedeomyia squamipennis* appear in considerable proportion. The former is second only to *Anopheles albimanus* in a catch from traps employed to capture mosquitoes attempting to enter habitations. The *Aedeomyia squamipennis*

all came from Gatun. *Mansonia titillans* occurred also in a lot from Miraflores. The explanation of the appearance of these mosquitoes in numbers is that the creation of the lakes at Gatun and Pedro Miguel has furnished an extensive habitat for *Pistia* and thereby abundant opportunity for *Mansonia* and *Aedeomyia* to breed.

In the discussion of Mr. Knab's paper Mr. Busck said that the eradication of certain species of mosquitoes as well as of many other insects on the Canal Zone was no more than could be expected as a natural result of the canal work and the sanitary measures in connection therewith. As the large trees with their host of water-bearing, mosquito breeding plant parasites are cut down and the bamboo swamps are drained, the shady habitat and characteristic breeding places of very many species of mosquitoes are entirely abolished and the extermination within the Canal Zone of such species is necessarily effected.

It is more noteworthy that certain other species of mosquitoes hitherto absent, or at least rare on the Zone, should have become established and abundant in spite of the constant warfare against mosquitoes by the Sanitary Department. But such is certainly the case with the two species *Mansonia titillans* and *Aedeomyia squamipennis*.

The reason for this lies in their peculiar biology, closely associated with and dependent upon the water-plant, *Pistia*, which make the larvæ of these species practically unaffected by any of the hitherto used control measures.

The *Pistia* formerly occurred only sparingly and in small colonies, mainly in the so called "Black Swamp," but the plant has now enormously increased, due to the greatly enlarged open areas of water, especially by the formation of the Gatun Lake, which now covers the Black Swamp. Large floating islands of *Pistia* now occur and afford unlimited breeding possibility for the two mosquito species which attach themselves to the roots of the *Pistia*. The effect was particularly noticeable on the part of the lake which was formerly the Trinidad River and where *Aedeomyia squamipennis*, unknown hitherto from the Canal Zone, this summer came by the hundreds every night, attracted by my acetelyn lamps and white sheets.

In combating these species the Sanitary Department on the Zone will have a new problem and it will probably be necessary to fish up or otherwise destroy these large floating islands of *Pistia*.

Under the heading of short notes Mr. Schwarz exhibited specimens of the Curculionid *Anthonomus irroratus* Dietz and berries of *Eugenia buxifolia* collected by him on the island of Key West, Florida during the month of April. These berries resemble good-sized peas and the Anthonomus was bred in some number from such berries which are slightly deformed. Upon further investigation it was found that the author of these deformations is a Cecidomyid. It appears that the Anthonomus larva destroys in some way the Cecidomyidous larvæ. Mr. Schwarz remarked that this is not the first instance known where species of Anthonomus are reported as being inquilinous in Cecidomyidous galls as instanced by *A. sycophanta* Walsh, and *A. aencolus* Dietz. Finally Mr. Schwarz stated that *A. irroratus* is manifestly synonymous with *A. costulatus* Suffrian, described from Cuba and that the latter specific name has priority.

Meeting of December 5, 1912.

The 263rd regular meeting of the Society was entertained by Mr. C. L. Marlatt at the Saengerbund Hall, 314 C Street N. W. on the evening of December 5, 1912, There were present Messrs. Baker, Barber, Busck, Caudell, Cory, Craighead, Cushmann, Duckett, Dyar, Ely, Fisher, Foster, Gahan, Heidemann, Heinrick, Hood, Howard, McIndoo, Quaintance, Rohwer, Sanford, Sasscer, Scott, Schwarz, Shannon, Viereck, Walton, and Wood, members; and Mr. G. E. Bodkin and Dr. G. F. White visitors. President Quaintance occupied the chair. The minutes of the preceding meeting were read and corrected.

Mr. Rohwer read his report as Secretary-Treasurer. The chair appointed Dr. Dyar and Mr. Caudell as Auditors. Mr. Schwarz moved that the Society extend Mr. Rohwer a vote of thanks for the efficient manner in which he has conducted the financial affairs of the Society during the past year. Carried.

Dr. Dyar as editor reported that three numbers of the Proceedings had appeared during the year and that a fourth number was now in the hands of the printer. Dr. Howard moved that the Society extend to Dr. Dyar a vote of thanks for the able manner in which he has edited the Proceedings and for his interest in financing this publication. Carried.

The following names were proposed for active membership:—N. E. McIndoo, J. B. Gill, J. Malloch, and R. C. Shannon of the Bureau of Entomology and Prof. J. B. Parker of the Catholic University. Under suspension of the rules all five were elected.

Under new business the recording Secretary read the amendments to the constitution proposed at the 262d meeting. These amendments were voted on by paragraphs and adopted.

The following officers were elected for the year 1913: President, August Busck; First Vice-President, W. D. Hunter; Second Vice-President, A. N. Caudell; Recording Secretary, E. R. Sasscer; Secretary-Treasurer, S. A. Rohwer; Editor, J. C. Crawford; additional members of the Executive Committee: E. A. Schwarz; L. O. Howard and Nathan Banks. Prof. A. L. Quaintance was nominated to represent the Society as a Vice-President of the Washington Academy of Sciences.

At the request of President Quaintance, Mr. G. E. Bodkin, Government Economic Biologist of British Guiana, South America, gave a short account of Economic Entomology in his part of the world of which the following is a brief résumé:

Briefly indicating the geographical position of British Guiana he went on to describe the insect pests attacking the principal crop, which is sugar cane. The giant moth borer (*Castnia licus*) bores out the center of the canes and thereby has caused enormous reductions in the yields of sugar during recent years.

No parasites of this pest have yet been discovered for in all the stages of its life history it is singularly well protected. The eggs are deposited singly and the young larvæ on emergence from the egg, bore directly into the cane, undergoing the larval and pupal stages in that position. The moths are diurnal.

The small moth borers (species of *Diatræa*)also cause very considerable damage, and the weevil borer (*Sphenophorus sericeus*) is at times harmful. Shot hole borers (a species of *Xyleborus*) invariably attack canes that have been previously weakened by fungi.

Rice is also grown on an extensive scale, chiefly by native farmers (coolies imported from India). This crop is not seriously injured by insects as a general rule, but this season the young rice was in many cases entirely destroyed by *Laphygma frugiperda*. This insect in company with many other pests appeared in enormous numbers at the commencement of the wet weather, which, this year followed a prolonged drought.

Mr. Bodkin also said that in the future he hoped to have more attention paid to the insect fauna of British Guiana; for from an entomological point of view it is an extraordinarily rich, interesting, and practically untouched field. He also expressed his gratitude to those who had offered to assist him in this project.

NOTES ON THE YELLOW CRANE-FLY, TIPULA FLAVICANS FABR.

By A. N. Caudell, *Bureau of Entomology.*

On October 28 of the present year I found the above named insect in great numbers at Rosslyn, Virginia. They had issued from clay soil near the river in a situation subject to inundation and at most times very moist. Many hundred adults were flying about and the pupal shells were found in numbers on the ground beneath the thin layer of leaves and debris which had accumulated since the last overflow of the river. As shown by an examination of many old shells the pupa always project a considerable distance out of the ground when the adult emerges. Ordinarily they project about one-half to two-thirds their length, rarely as little as one fourth but often more than two-thirds, in some cases the shells being found entirely clear of the hole of issuance, indicating that they were entirely withdrawn by the adult in emerging. The soil is of a yellow clay nature and well filled with small rootlets upon which the larvæ of the fly probably feed. The occurrence of this species covers some weeks as Mr. Knab found them plentiful at this same locality as early as September 22. Still earlier in the season, in early August, this same situation was populated by another nearly related Tipulid of very similar superficial appearance and also a blackish marked species. Indeed this locality seems to be one very rich in its Tipulid fauna.

Many of these flies observed at Rosslyn were copulating, some during flight and some at rest on the ground or on leaves or twigs. In one case observed by me an apparently freshly emerged female sat on the ground within an inch of what I presume was the pupal shell from which she had issued and was quite covered with a yellowish mass of males. There were six of these males massed over and around this female, one of them mating with her, the other five sitting almost motionless, some with the mouth parts touching her abdomen.

In 1886 J. Mik[1] records observations on certain Tipulidæ mating when the female is freshly emerged. He states that the males sit and wait for the emergence of the females and when they appear mating commences immediately, even before the legs are entirely clear of the pupal shell and while the abdomen is still limp and watery. Observations of this character were made on species of three genera, *Cylindrotoma*, *Dicranomyia* and *Trochobola*. Mik records these observations to refute the idea advanced by another writer that the deposition of fertile eggs by a soft bodied freshly transformed female Coccinellid beetle was a case of parthenogenesis. Mik argues that, while the insect is not fully developed externally, it is sexually perfect internally.

Needham,[2] describes and figures the pupa of *Tipula flavescens* and states that he bred them in late September from clay subsoil brought up by crayfish in a glacial "pothole" in the state of Illinois.

Many hundreds of the specimens observed by me at Rosslyn, Virginia, were killed by some fungus disease. Dead flies were found in some abundance sitting head upwards on twigs and weed stems, sometimes singly but generally two or more together, often as many as five or six being found in a mass. The abdomens of the dead flies were found to be filled with a pulpy mass similar to that filling the bodies of fungus-killed lepidopterous larvæ. Flies freshly dead look as if perfectly well and active, unless it be that the legs are wrapped more securely around the twig or stem to which it clings. Specimens of these fungus-infested Tipulids were turned over to Prof. Webster for study and determination of the fungus. Other specimens are preserved in the National Museum collection.

LUMINOUS COLLEMBOLA

By Herbert S. Barber, *Bureau of Entomology.*

Very few of us walk at night in woodland paths without a lantern and this fact is perhaps the explanation of the extremely meager data available on the subject of luminous Collembola. The almost universal ignorance here in America, that such photogenic function occurs in this order is, it is hoped, sufficient apology for the presentation of the following very imperfect observations, and résumé of previous notes which have been brought to my attention. It is hoped that these notes will yield an abundant crop of corroborative and advanced data by the end of another

[1] Ent. Nachr., vol. xii, p. 315.
[2] Bull. New York State Museum, No. 68, p. 280, 1903.

season. Histological work on the photogenic organs of these primitive forms may be of much value in the problem of photobiogenesis.

One night last fall (October 18, 1912) the writer went to a spring in the woods on the Virginia shore of the Potomac opposite Plummer's Island, and noticed a faint point of light on the wet surface of a rock, which was at first mistaken for a young glow worm. A pocket electric flashlamp was held close to the luminous point and then lighted, revealing a small common-looking Collembolan. Thinking a mistake in location had been made the light was put out and when the eyes were again adjusted to the darkness the luminous point was located exactly by placing a finger on each side and the electric light again flashed on, corroborating the first observation. The live specimen was then gotten into a clean vial and examined with a hand-lens in the dark and also by artificial light. No local light organs were to be seen, the light being constant and general but not intense enough for one to see the legs or antennæ. The possibility of its being a case of infection by luminous fungal or bacterial growth was considered but as the specimen remained alive and luminous for three nights this hypothesis seems improbable. More specimens were sought immediately and in moving a leaf a very short dim flash attracted attention. When the light was thrown on the place a minute (about 1 mm. in length) white Collembolan of another genus was found but as it was not seen to flash again it was not taken, the impression of the flash being thought to have been an optical illusion similar to "seeing stars." When, however, ten minutes later the same impression of a very short, weak flash was again caught and traced to the same kind of minute white Collembolan which, happily, flashed a second and a third time while under examination, it became evident that the flash was not subjective but objective. Further search that night was without success. Although the two little creatures, alive in a moist vial, were looked at frequently no light was again seen from the small one. The next evening more specimens were sought, but only two, one of each kind, were found. These acted as on the previous evening but the larger was crushed and lost in trying to get it into a vial. The smaller one was only seen to flash twice. Colder weather, and the increasing light from the moon made several more attempts to find material fruitless.

The specimens were sent to Prof. J. W. Folsom who kindly determined the larger form as a species of *Anurida* hitherto unreported from this country which may prove to be one of the European species, while the smaller form agrees fairly well with *Neanura quadrioculata* Guthrie.

The light of *Anurida* was a continuous, pale greenish-yellow glow general throughout the body, and with a lens of $1\frac{1}{2}$-inch focus could not be seen to be more intense in any organ of the body, but failed to display the legs and antennæ. The specimens of *Neanura* were only seen to flash at the time of their capture, and then not while looking at them with a lens. The impression received was that the flash was very short, perhaps between one fifth and one-half second duration as compared to the average camera shutter speed, and was repeated after perhaps 20 seconds, while the third flash (seen the first evening) was so faint as to be easily missed. The fact that the light is flashed excludes the idea of infection by, or feeding upon luminous bacteria, or fungi, as a cause of the light while the length of time that the *Anurida* lived in the vial (more than three days) would seem to indicate that its light also is primary.

The luminosity of the nests of Brazilian termites described by Castlenau (1850), Smith (1879), Severiano da Fonseca (1880), and Knab (1895) (1909),[1] is of interest in this connection for the descriptions of the multitude of minute moving lights which covered the surface of the nests is strangely similar to the impression received from reading Allman's or Dubois' account of the appearance of the ground where the luminous Collembolans were found. Urich's account[2] appears to refer to another sort of luminosity, probably "foxfire."

As will be noticed the writer's observations on the light of *Anurida* compare closely with Allman's and Dubois' observations on *Anurophorus fimetareus* and *Lipura noctiluca* respectively, while the flashes of *Neanura quadrioculata* (?) are similar but probably fainter than those seen by Molisch to emanate from *Neanura muscorum*. The notes by these three observers are the only other original observations that have come to the writer's attention.

Mr. F. Alex. McDermott in answer to my queries was kind enough to cite various accounts of luminous springtails and in order to bring before American observers the data found in looking up these notes they are briefly abstracted and appended chronologically, the first mention being quoted entire.

1851 Allman, Proc. Royal Irish Acad. Dublin, vol. 5, p. 125. "On the omission of light by *Anurophorus fimetareus*." The note in full follows:

"Professor Allman read a notice of the emission of light by *Anurophorus fimetarcus* Nicolet (*Leptura fimetarea* Linn.). During a walk over the Hill of Howth near Dublin on a dark night in February last [1851] he was

[1] See Science, October 22, 1909, vol. xxx, pp. 574–575 and Science, January 7, 1910, vol. xxxi, pp. 24–25.

[2] Journ. Trinidad Field Naturalists Club, vol. ii, p. 288, 1896.

struck with a luminous appearance in the earth when disturbed to a depth of three or four inches; the light proceeded from numerous distinct points and lasted for more than a minute after its first appearance. On carrying home some of phosphorescent earth Dr. Allman was enabled to trace the phenomenon in question to the presence of numerous living individuals of *Anurophorus fimetareus*, from each of which there proceeded in the dark a faint but very evident emanation of light. Specimens of the insect preserved alive in a glass phial continued for many nights to exhibit this beautiful phenomenon which was also witnessed by Dr. Stokes and Mr. Haliday as well as by numerous other friends whose attention was directed to it by Dr. Allman. The light could not be traced to any definite point in the insect. The Anurophorus was very abundant on the hill and subsequent observations proved that the dark peaty soil which abounds in some places on Howth was almost the only part of this district from which it could be affirmed to be absent."

1885 Dubois, C. R. Soc. d. Biol. Paris, vol. III, ser. 8, pp. 600-603. "Le function photogenique des Podures" mentions Allman's observations and gives detailed account of his own observations on luminous Podurids (similar to *Lipura ambulans* and *L. armata*) near Heidelberg in October 1881.

1890 Gadeau de Kerville, Les animaux et les vegetaux lumineux, pp. 98-100, knew only the two accounts just cited.

1894 Dubois, Rev. Général des Sci. Pures et Appliqués, vol. v, pp. 415-422, and 529–534; not seen by the writer but the following is said to be an English translation of it.

1895 Dubois, Rep. Smithsonian Institution for 1895, p. 418, plate xxiii, briefly mentions luminous Collembolans as causing, when numerous, the soil in certain continental localities "to become luminous like the sand of the sea which contains Noctilucæ." He knew but one luminous species which he figures as *Lipura noctiluca*.

1896 Packard, Jour. N. Y. Ent. Soc. vol. IV, p. 61, alludes to the luminous Poduran *Anurophorus*. This is the only reference found in the American literature but is probably based upon Allman's observation.

1898 Dubois, Leçons de physiologie generale et comparée, Paris, pp. 418-420, quotes his previous account of his observations near Heidelberg, of Oct. 1881 on the species which is again figured as *Lipurca noctiluca*.

1904 Molisch, Leuchtende Pflanzen, Jena; notes the light of *Neanura muscorum* Templeton. In the autumn of 1901 he took a

piece of rotten wood near Prag and placed it in a glass dish to examine occasionally for luminosity. It remained nonluminous for a fortnight but then, when shaken in a dark room flashed, to his amazement, with many fine points of light—the flashes lasting from several seconds to half a minute. Knowing the light of fungi to be constant and spontaneous, i.e., not subject to stimulation, he concluded he must have an animal organism to deal with and, although difficult on account of the minute size, was able to ascertain that the light eminated from the little springtails. When isolated in a small tube these insects would flash on being shaken, but after a few repetitions the faculty of producing light seemed exhausted until after a time at rest, when they would again respond to mechanical stimulus with a sudden flash. He cites Dubois (1898) and concludes that other forms of the Collembola may also be found to be luminous.

1904 Ludwig, Promethus, Jahrgang 16, pp. 103-107, cites Allman, Dubois (1886) and Molisch and gives a lengthy discussion of the possibility of luminosity being a result of feeding on, or living in contact with luminous fungal or bacterial growths.

1905 Pütter, Zeitschr. f. allegemein. Physiologie, Sammelreferate, 1905, p. 23, in a long article on luminosity in general, refers to Molisch's discovery.

1910 Mangold, Winterstein's Handbuch der Vergleichenden Physiologie, vol. III, 2, p. 290, in his long article "Die Produktion von Licht" leaves the Thysanura with the groups of insects doubtfully luminous, and gives a condensed paragraph referring to the Allman, Dubois, and Molisch observations.

Under the heading of short notes Mr. A. N. Caudell presented the following:

On October 1 of the present year I collected at Rosslyn, Virginia, seed heads of a species of *Bidens* many of which were infested with weevil larvæ, a single larva to the head. The larva lay hidden beneath the withered ends of the seeds it had consumed, Further search revealed some pupæ also, and later adults issued, proving to be *Conotrachelus geminatus* Fabr. This weevil is not common and its habit of pupating in seed heads seems unusual. The late Mr. Ulke collected specimens here in the District and the National Museum collection contains material from New York, New Jersey,

Ohio and Iowa as well as doubtfully determined specimens from Little Rock, Arkansas and Montreal, Canada.

As two of the eight or ten infested seed heads mentioned above contained pupæ of a hymenopterous parasite the percentage of parasitism appears to be quite large. Adults of the parasite issued a few days later and were identified by Mr. Viereck as the *Sigalphus curculionis* of Fitch.

EASTERN SPECIES OF RACHICERUS

The three species of the East occur near Falls Church, *R. flavicollis* at Glencarlyn in July; *R. obscuripennis* L. at Great Falls, fairly common, flying low and slow in June; and *R. nitidus* John. also at Great Falls in June. They may be separated as follows:

1. Thorax yellowish, legs (except tips of tarsi) yellowish; antennae of ♂ pectinate, ♀ hardly so—*flavicollis* Halid,
   Thorax dark, only humeri yellowish 2
2. Legs (except tip of tarsi) yellowish, thorax shining black, stigma and cloud beneath prominent; antennae hardly pectinate *nitidus* John.
   Femora and tibia more or less obscured; thorax dull blackish, stigma not prominent; antennae of ♂ strongly pectinate, of ♀ less so ..... *obscuripennis* Loew

R. obscuripennis varies, much in size, some females being twice as long as others.

N. Banks.

ASILIDS CATCHING HYMENOPTERA

Poulton has listed a considerable number of Asilids that commonly capture Hymenoptera. Besides his records are those of Cockerell, Daecke, and Laurent in Entomological News, and the oft-quoted habit of *Promachus* in catching the honey bee. At Falls Church I have taken *Deromyia ternatus* on three occasions with a species of *Vespa*, and once with a honey bee; and *Mallophora claucella* with a species of *Epeolus*.

N. Banks.

NOTES ON DIPTERA

In Can. Entom., 1911, p. 130, I described a new species of *Laphria* as *L. dispar;* I find that the name is preoccupied and would replace it by *Laphria disparella* n.n.

In the fall of 1912 I took two rare Tachinids, *Euceromyia robertsoni* Towns. at Falls Church, September 14, and *Trichopoda plumipes* Fabr. at Great Falls, October 3. The *Euceromyia* was unknown to Coquillett, and the genus not in his table.

N. Banks.

Actual date of issue April 9.

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PROCEEDINGS

OF THE

ENTOMOLOGICAL SOCIETY

OF WASHINGTON

VOL. XV 1913 No. 2

Meeting of January 10, 1913.

The 264th regular meeting of the Society was entertained by Prof. A. L. Quaintance at the Saengerbund Hall, 314 C street N.W., on the evening of January 10, 1913. There were present Messrs. Barber, Busck, Caudell, Craighead, Crawford, Cushman, Duckett, Fisher, Gahan, Gill (J. B.), Gill (T. N.), Green, Hall, Heinrick, Holloway, Hood, Hopkins, Howard, Hunter, Johnson (F.), Knab, McAtee, McGregor, McIndoo, Malloch, Marlatt, Morgan, Myers, Parks, Popenoe, Quaintance, Rohwer, Sasscer, Schwarz, Shannon, Siegler, Snider, Walton, Wood, members, and Messrs, A. H. Clark, W. T. M. Forbes, W. H. Sill, F. L. Simanton, and J. F. Strauss, visitors. President Busck occupied the chair. The minutes of the preceeding meeting were read and corrected.

Mr. Rohwer stated the the Auditing Committee had examined his accounts as Corresponding Secretary-Treasurer and found them correct.

Mr. Rohwer read a communication from the International Committee on Nomenclature requesting the coöperation of the Entomological Society of Washington by appointing two of its members to serve on the American Committee of Entomological Nomenclature. After reading the letter, Mr. Rohwer spoke of the recent action of the Executive Committee in recommending Messrs. Crawford and Caudell to represent the Society. Doctor Howard suggested the name of Dr. C. W. Stiles, whom he considered to be admirably fitted to serve on such a committee. A ballot was taken resulting in the election of Mr. J. C. Crawford and Doctor C. W. Stiles.

Mr. Quaintance then read his address as retiring President as follows:

ANNUAL ADDRESS OF THE PRESIDENT.

REMARKS ON SOME OF THE INJURIOUS INSECTS OF OTHER COUNTRIES.

By A. L. Quaintance.

Our knowledge of the injurious insects of the world at large with the exception of Europe and one or two other regions, is, on the whole, quite meagre. During the past decade or so, it is true there has been a notable increase in the attention given by governments to the subject of economic entomology in their respective territories, and numerous publications are now appearing, dealing with the insects noxious to crops, forests, domestic animals, etc. and especially to man himself. The importance of such work in general has been perhaps the more quickly appreciated in view of the numerous brilliant discoveries in the field of medical entomology, which from the start have been of the greatest practical value. The economic investigations along various lines, now well under way, or but recently begun in many lands, will in due time make known the more noxious species with which the people of other countries have to deal.

The extent to which work of this kind has been undertaken may be judged by citing some of the countries where economic work has been or is now in progress, as Japan, Java, Straits Settlements, Fiji, Australia, New Zealand, South Africa, Natal, British East Africa, India, Ceylon, Egypt, Turkestan, Chile, Brazil, Argentina, Uruguay, Peru, British Guiana, the West Indies, Mexico, etc.

In view of our constantly increasing commerce with other nations, knowledge of their insect pests is of prime importance, as enabling us to better guard against their introduction. Aside from practical considerations, however, much scientific interest attaches to the biologic and other features of economic investigations in other countries, which contain much of inspiration and suggestions for us. The writer personally has felt the need of a greater familiarity with the destructive insects, occupying the attention of entomologists abroad; and in the belief that this feeling may be shared, to some extent, by members of this society, he has brought together for your consideration tonight condensed remarks on some of the insects which attack crops outside of North America.

Without doubt reference will be made to insects which really do not merit mention on account of their economic importance, and

species will have been omitted which should have been mentioned. It has not been possible to so thoroughly review the literature as to be reasonably sure even, of including all of the prominently injurious species, and it has often been impossible to decide upon the proper economic status of a species from the authors' remarks. These details, however, lose some of their importance when we remember that the behavior of a given species in its natural habitat does not necessarily warrant the conclusion that it would be equally or more injurious if introduced into another country, though the assumption that it would, under a new environment, maintain, or even surpass, its reputation as a pest, is unquestionably a safe one. Of special importance, however, is a knowledge of the food habits and life history of a species, which considered in connection with its original habitat and systematic position, furnish adequate grounds for conclusions as to its probable dangerous or innocuous character.

Time does not permit to dwell on the many interesting questions related to a subject of this kind, which, of itself, is too large to properly be considered in an address of this character. For instance, it would be of much biological interest, and of very probable practical value to summarize our knowledge as to what extent insects from other Zoölogical regions, as the Oriental, Neotropical, Ethiopian, etc. have adapated themselves in the Nearctic and in what life zones in North America they thrive and prove noxious. As is well known, Palearctic forms, especially European, constitute the bulk of our imported injurious pests, though many exceptions must be noted.

ISOPTERA.

Practically none of the Neuropteroid orders of insects are injurious to crops, with the exception of the Isoptera, which contains two families, many species of which are at times plant enemies, but especially of houses and other wooden structures.

The well known *Termes lucifugus* of Europe is a pest of buildings also attacking garden crops.

Termes obesus Ramb. is probably the species responsible for the large amount of damage in India to houses, crops and trees. In Ceylon *Calotermes militaris* Desn. and *C. greeni* Desn. are periodically pests of the tea plant. *Termes lacteus* Frogg. is destructive to buildings about Sydney, and in the woods, builds tall rounded nests or mounds, some of them 6 feet high. *Coptotermes gestroi* Wasm. is destructive to numerous plants in tropical Asia, as *Hevea brasiliensis*, mango, coco nut palm, etc.

In Formosa, *Termes vulgaris* Hav. is very destructive to sugar cane, the insects eating the roots and parts below the soil, often

killing the young plants. In Turkestan *Hodotermes turkestanicus* is noted for injuries to telegraph poles.

ORTHOPTERA.

Representatives of this order have been scourges to mankind from the earliest times, and accounts of their ravages occupy prominent places in entomological literature. All families, save one, contain injurious species, but the following especially merit notice.

Locustidæ (Acridiidæ).

Schistocerca paranensis Burm. is the destructive locust of Argentina and surrounding regions of South America. Its distribution is given as Argentina, Brazil, Uruguay and Chile. *S. tartarica* L. (*C. peregrinum* Stal.), a similar species, and with which the above has been at times confused, is an insect of the greatest importance in northern Africa, and western Asia. It occurs in southern Europe and is recorded from South and Central America. In the Sudan this species is stated to be the most important of all insect pests to crops.

Orthacanthacris ægyptia L., the *Acridium ægypticum* of some authors, ranges over southern Europe, northern Africa and western Asia. Its history as a devastating species is too well known to require comment. Another important form, *Calliptamus italicus* L., ranges as far north as central Europe, and also inhabits northern Africa and western Asia. *Dociostaurus moroccanus* Thunb., periodically swarms over Algeria, living permanently in the higher altitudes. This species ranges over about the same distribution as the foregoing, and also occurs in Madeira.

Colemania sphenarioides Bol., the so-called "Jolo Grasshopper," and *Hieroglyphus banian* Fab. are first class enemies of cereals, rice, etc. in Mysore State, the latter occurring also in China and India. In Formosa *Oxya intricata* Stal and *O. velox* Fabr. are destructive enemies of rice, and *Gelastorhinus esox* Burr. does similar injury in Formosa, and also in Japan.

Cyrtacanthacris septemfasciata Serv. is the plague locust of Natal, central and southern Africa, and is present in Borneo. This species particularly was the cause for the foundation of the South Africa Central Locust Bureau. Another species, the brown locust of South Africa, *Locusta pardalina* Walk. is also a pest of prime importance. Some other species merit mention almost equally with the foregoing.

Anent locust ravages in northern Syria, it was stated in the daily consular and trade reports that the commission appointed by the government required every rural inhabitant to collect and

deliver at least 55 pounds of locust eggs. In this way a total of 629,882 pounds of eggs were collected.

Achetidæ (Gryllidæ).

In this family are several species frequently noted in economic literature. The mole cricket of the West Indies, *Scapteriscus didactylus* Latr., is excessively injurious to tobacco, sugar cane and various other crops in Porto Rico. It is present in various islands of the West Indies, and occurs in South and Central America and in Mexico. Its presence in the southern United States is a well established fact.

Gryllotalpa africana Beauv. is recorded from Asia, Africa, Australia and New Zealand. In Uganda and Formosa, it is said to be extremely injurious to rice. *Oecanthus pellucens* Scop. occurs in southern and central Europe, western and central Asia. It punctures grape canes and stems of other plants like our *O. nigricornis*.

Acheta bimaculata DeG., in Formosa, is very injurious to young vegetation of various kinds, especially cotton, tea, etc.

THYSANOPTERA.

There are many species in this order which have shown themselves in the United States and elsewhere to be formidable enemies of crops, as *Euthrips pyri*, *E. citri*, and *Thrips tabaci*. The habits of these insects, in some cases, are quite favorable to their dissemination from one country to another, and numerous species are already widely scattered over the world.

Limothrips denticornis Haliday occurs generally over Europe, and infests oats, barley, and various fruits. *L. cerealium* Haliday, the so-called corn thrips, is distributed over all Europe. It is considered by Uzel as one of their more destructive species, injuring corn, wheat, oats and grasses, the attack causing the grains to shrivel and become abortive. *Heliothrips hæmorrhoidalis* Bouché, a species which Bouché thought to be native to America, is widely distributed over Europe and occurs in Australia. It is destructive to numerous plants, and is one of our more injurous forms. *H. rubrocinctus* Giard, the cacao thrips, is spread over the West Indies, where it is one of the prime enemies of cacao, attacking the pods, tender shoots and foliage. It also injures the cushew, guava, mango, etc. and is recorded from Uganda. The insect has recently made its way to Florida.

Thrips communis Uzel, in Bohemia, injures potatoes and beets, where it is regarded as quite destructive. *T. flava* Schr. injures blossoms of pear, apple, plum, cherry, etc. and occurs on vegetables. In England, this species with *T. physopus* L. are known as pear

thrips. The former species occurs in widely separated regions in Europe and is probably generally present over the entire region.

T. minutissima L., present in England, Germany and Bohemia, is another general feeder like *flava* and has about the same distribution. *Thrips sacchari* Krueger with *T. serrata* Kobus attacks sugar cane in Java. *Stentothrips gramineum* Uzel is injurious to barley and other grains in Bohemia, while *Drepanothrips reuteri* Uzel is injurious to grape foliage in Sicily, especially to certain American varieties (Riparia). *Phloeothrips oleæ* Costa is one of the important olive pests in portions of Europe, injuring the fruit and foliage. *P. pallicornis* injures sugar cane in Formosa.

It is apparent that our knowledge of the injurious Thysanoptera is confined mostly to Holarctic forms. It is quite certain that other regions will furnish many species which, in their present or new environment, will be quite troublesome.

HEMIPTERA.

Species of the order Hemiptera are of especial interest to crop producers, for the sum total of losses for which they are responsible, would amount to no small part of that chargeable to insects as a class.

HETEROPTERA.

Pentatomidæ.

Two species of the genus *Eurydema*, namely, *ornatum* L. and *oleracea* L. are pests of cruciferous plants in Europe, and much resemble in habits and general appearance our harlequin bug. The former species occurs over most of Europe, Asia Minor, parts of Russia, Turkestan, etc. The latter is even more widely distributed and is recorded from all of Europe, Western Russia, Turkestan and Siberia.

Several species, assigned to this family, are important in Australia, as *Stilida indecora* and *Rhoecocoris suleiventris*, which, both in the immature and adult stages swarm over orange orchards, sucking sap from branches, causing the fruit to fall. *Biprorulus bibax* is also an orange pest and is known as the spined orange bug. *Philia basalis* is one of the common fruit bugs of North Queensland, and the so-called cherry bug, *Peltophora pedicillata* ranges from New South Wales to North Queensland. A similar species, *P. picta* Germ. also punctures cherries, causing the fruit to fall. In South Africa, *Bagrada hilaris*, the Bagrada bug, injures cruciferous plants like our *Murgantia histrionica* Hahn. This insect occurs over central Africa, Algeria and the Arabian Desert. *Bagrada picta* Fabr. also infests cruciferous plants in India. *Plantia affinis* Dallas infests growing rice in New South Wales.

Aenaria lewisi Scott does much damage to rice in Japan by piercing the heads. The insect is single brooded, the adults hibernating under trash in field and woodlands. *Cuspicora simplex* Walker the brown potato bug, and *C. virescens* Tryon, are potato pests in the Illawarra and Toowoomba districts of Australia.

Coreidæ.

In this family are several important species, though but few are seriously destructive. One species, the rice or paddy bug, *Leptocorisa varicornis* Fabr., is a serious pest to rice, ranging over Japan, China, India, Ceylon, Philippine Islands, etc.

Mictis profana, the crusader bug, is abundant in citrous orchards in Victoria and punctures the shoots, blighting the twigs, often causing the crop to fall.

Lygæidæ.

Nysius vinitor Bergroth, the Ruthergren bug of Australia, punctures fruits, as grapes, peaches, and the like, causing them to rot, and is considered one of the most destructive plant bugs on that continent, swarming over fruit and foliage in countless millions.

Oncopeltus quadriguttatus, the cotton bug, is common on cotton in the Richmond River section and ranges from Sydney to Queensland. *Oxycarænus lætus* Kirby is a cotton pest in many parts of India. Only twelve days are required from egg to adult.

Pyrrhocoridæ.

This family is of interest principally on account of several members of the genus Dysdercus, which contains species quite injurious to cotton in various parts of the world. There are some four or five Nearctic species and a single one from the Paleartic region, *D. crucifer* Stal occurring in Japan, the Philippines, etc. Some twenty species occur in the West Indies and South and Central America.

Dysdercus sidæ infests cotton in New South Wales, staining the cotton fleece with its excrement, in common with the other forms of the genus, which seem always to infest cotton when grown within their range of distribution. *D. cingulatus* Fabr. is abundant on cotton in India, while *D. fasciatus* Sign. is the cotton stainer bug of South Africa, occurring also in Portuguese East Africa. Another species, *D. superstitiosus* frequents cotton on the Cape. *D. insularis* and *D. pacifica* occur on cotton in Fiji, but have not as yet caused much trouble. Certain species are pests to the south of us, i.e., *D. ruficollis* L., in Peru; *D. howardi* Ballou, considered quite important in Trinidad and Tobago; and *D. andreæ* L. in Cuba. *D. delauneyi* Leth. is common in the Southern Islands. The harle-

quin bug of Australia, *Dindymus versicolor*, is a Pyrrhocorid and punctures ripe fruits.

Tingitidæ.

Urentius echinus Dist. occurs on egg plants in India, though not as yet troublesome. The olive tree bug, *Froggattia olivina*, of New South Wales, has turned its attention from the wild to the cultivated olives, sometimes defoliating the trees. *Stephanitis (Tingis) pyri* Fabr., which inhabits Europe, Asia Minor, Russia, Japan, etc., is injurious to foliage of pear and is mentioned in most European works on economic entomology.

Capsidæ.

In this extensive family, the species mostly live on plants and a few are of importance. The famous mosquito blight of tea in India and Ceylon is due to *Helopeltis theivora* Waterhouse while *H. bradyi* Waterhouse injures cacao in Java. *Disphinctus politus* Walker attacks the betel vine and *D. humeralis* Walker injures Chincona, in India. *Gallobellicus crassicornis* Distant, is a garden pest in Bombay, and in Pusa, attacks and breeds on tobacco.

Calcoris angustatus Leth. attacks sorghum in South India. *C. trivialis* Costa injures the olive, vegetables, etc. in portions of southern Europe, and is present over northern Africa.

HOMOPTERA.

Cercopidæ.

The Cercopidæ, though not numerous in species, are widely distributed over the world, though not many are troublesome to crops.

Tomaspis varia Fabr., the sugar-cane frog hopper, is just now attracting considerable attention in Trinidad and Tobago. The young feed on roots of the sugar-cane plant, following these in cracks in the soil, and the adults feed on the the leaves. *T. postica* Walker occurs on sugar-cane in Mexico. *Philœnus spumarius* L. injures the sugar beet in Bohemia. *Ptyelus costalis* Wk. is a pest of rice and sugar cane in Formosa.

Jassidæ.

This family has been but little worked in the newer parts of the world, though a few important species are to be mentioned as crop pests. *Nephotettix apicalis* Motsch. is a serious enemy of rice in seed beds in Japan and Formosa, and has caused a loss of $10,000,000 in a single year. The species ranges over Japan, China, Cey-

lon, the Philippines, etc. Another Jassid injuring rice in India is *Tettigoniella spectra* Dist. Three species of *Idiocerus* injure the shoots of mango in Saharanpur, namely, *I. clypealis* Leth., I. *niveosparsus* Leth. and *I. atkinsoni* Leth. *Chloritia (Eupteryx) solani* Kollar is the potato frog fly of England, as stated by Miss Omerod. *Thamnotettix fuscovenosus* Ferr. occurs in Italy, Corsica, Greece, Austria, etc., and in some regions injures the olive. *Typhlocyba viticola* Targ. injures the grape in Italy, as does *flavescens* in northern Africa. In Bohemia several species of Jassids injure the sugar beet, as *Cicadula sexnotata* Fall., *Eupteryx atropunctata* Goeze, etc. *Zygina subrufa* Motsch., *Deltocephalus dorsalis* Motsch. and *Strongylocephalus agrestis* Fall. attack rice and sugar cane in Formosa, the latter species injuring the same crops in Japan.

Fulgoridæ.

A notorious species in this family is *Perkinsiella saccharicida* Kirk., the sugar-cane leafhopper, which, on account of its injuries, led to the establishment in Hawaii of the Entomological Division of the Sugar Planters' Experiment Station. The pest is thought to have been introduced from Australia, and is known to occur in Java. Several other species injure sugar cane, as *Phenice moesta* Westw. and *Pyrilla aberrans* Walk., in India, and *Delphax saccharivora* West., which some years ago was troublesome in the West Indies. *Liburnia (Delphax) psylloides* Leth. injures corn in Ceylon and India. *Ricania zebra* Dist., in the same region, infests rice and grasses.

Hysteropterum grylloides Fabr. infests the olive, in Italy, and is general over all of southern Europe. Another European form is *Hyalesthes obsoletus* Sign. injuring young olives. *Dictyophora pallida* Dor. is the sugar cane fly of India, and is common in the Punjab, United Provinces, and Behar. Cane is said to be its only food plant.

Psyllidæ.

The injurious members of this family are mostly of the genus Psylla, and numerous forms of decidedly economic importance occur in the Palearctic region. Thus, *Psylla mali* Schmidbg. ranges pretty well over Europe, and is a decided pest of apples. In England it is known as the apple sucker, where it is considered one of the worst of all pests to this plant. *P. cratægi* Schr. occurs over Europe generally on apples and *Cratægus*. *P. pruni* Scop. is also distributed over much of Europe, including Siberia. It attacks plum and prunes. *P. pyri* L. occurs on pear and has about the same distribution as the foregoing. *P. pyrisuga* Forst., also attacking pear, occurs over much of Continental Europe, and is

also found in Japan. In France it is known as the orange Psylla on account of injuries to oranges. *P. cistellata* Buckton causes galls on mango in Dehra Dun. *Trioza obsoleta* Buck. attacks the persimmon in Thana and a species of this genus injures the young growth of citrus trees in South Africa, where it is known as the citrus Psylla. *Mycopsylla fici* is found on native figs in Australia. the larvæ hiding under the abundant milky sap which exudes from the punctures made. *Homotoma ficus* L. attacks the foliage of fig in Italy, the species being present also in Spain, France, Dalmatia, etc. The olive Psyllid, *Euphyllura olivina* O. Costa injures the olive and has about the same range as the preceding species.

Aleyrodidæ.

The Aleyrodidæ is a family of wide distribution in the temperate and tropical parts of the world. Many species have already attracted attention by their injuries and a few constitute quite destructive pests. *Aleyrodes citri* and *A. vaporariorum* may be cited as examples of very undesirable introductions already effected.

Two species injure tobacco, namely, *Aleyrodes tabaci* Gennadius, in Greece, and *A. nicotianæ* Maskell in Mexico. Sugar cane in Java is attacked by three species, namely, *Aleyrodes bergii* Signoret, *A. longicornis* Zehntner, and *A. lactea* Zehntner. The guava in Brazil is infested with *Aleyrodes horridus* Hempel and *A. goyabæ* Göldi. *Aleurodicus cocois* Curtis is a guava pest of importance in Trinidad, Venezuela and Brazil, and has long been known as troublesome to cocoanut palms in portions of the West Indies. A closely related species, *A. destructor*, seriously infests this plant in the Philippines.

In Europe, *Aleyrodes brassicæ* Walker has long been known as more or less destructive to cabbage, kale and other members of the cruciferous family. *Aleyrodes youngi* Hempel seriously infests cabbage in Brazil. *Aleyrodes ribium* Douglas occurs on red and black currants in England. Many other species might be mentioned as of possible or actual economic importance in foreign countries.

Coccidæ.

The Coccidæ, as a family, is of the greatest economic importance. The mode of life of the species favor their wide dissemination, and very many are now practically cosmopolitans. In this family especially it is difficult to surmise the behavior of a species introduced in a new environment, with abundance of food, etc. Mr. Sasscer has kindly assisted me in the selection of a few forms, not yet found in North America, and which are evidently of importance in their present range of distribution.

Icerya seychellarum West., attacks sugar cane, guava, palms, citrus etc., and occurs in New Zealand, China, Madeira, Mauritius, etc.

Phenococcus oleæ Marchal, is an olive pest in Tunis.

Pseudococcus sacchari Ckll. infests sugar cane in Cuba, Porto Rico, South America and probably elsewhere.

Pseudococcus perniciosus Newst. & Wilcox is a mealy bug very injurious to the lebbek in Cairo, Egypt, where the tree is grown for shade. It also occurs on the Christ's Thorn and Sunt.

Coccus (Lecanium) viride Green., the so-called green bug of Ceylon, infests a long series of useful plants, but is especially destructive to coffee. Its ravages to this crop have been practically responsible for the abandonment of its cultivation over the greater part of the planting districts of Ceylon.

Lecanium krügeri Zehnt., attacks cane in Java.

Three species of *Chionaspis* are Javanese cane pests, namely, *C. depressa* Zehnt., *C. sacchari-folii* Zehnt. and *C. madierensis* Zehnt.

Parlatoria pyri Marlatt occurs on pear and apple in Manchuria. From its affinities, it must be regarded as a suspicious character.

Aspidiotus oceanicus Lindinger is a pest of the coconut in the South Sea Islands, and *A. lauretorum* Lindinger, in the Canary Islands, infests a long list of plants, including Smilax, Hedera, Laurus, etc. *A. destructor* Sign., of very wide distribution outside of North America, occurs on the banana, coconut palm, tea, mango, and many other useful plants. *A. sacchari* infests sugar cane in Java.

Aspidiotus africanus Marlatt, of South Africa, is seriously destructive to the privet and fig, and infests, to a less extent, other cultivated plants, as apricot, quince and apple. It is also abundant on honey locust and pepper tree.

Leucaspis japonica Ckll., occurs in Japan, China, and South Africa, infesting apple, pear, maple, magnolia, etc.

LEPIDOPTERA.

In this order, practically all of the families contain species more or less important economically, though the actual number of families containing notably destructive forms is much less.

Nymphalidæ.

Brassolis isthmia Bates, the cocoanut palm butterfly is a troublesome enemy of its host plant in the Canal Zone.

Lycænidæ.

Virachola isocrates Fabr., in India, works havoc in pomegranate plantations and also injures guavas. *Zizera labradus* Godt. has

come into notoriety in Victoria by reason of its injuries to beans and peas. *Thecla pruni* L. injures plums in portions of Europe, but is not of much importance.

Hesperiidæ.

Three species of this family are noted as destructive in India. Larvæ of *Gangara thyrsis* Mo. are injurious to palms. The rice skipper, *Parnara mathias* Fabr. is at times destructive to rice, there being two broods on rice during the rains. *Telicota palmarum* Mo. occurs on date palm, and in widespread in India.

Castniidæ.

A single species of this interesting South American family is to be noted, namely, the giant sugar-cane borer, *Castnia licus* Drury. It is quite destructive to sugar cane in British Guiana. It has been collected in various localities in the northern half of South America and also in Nicaragua, Costa Rica and Trinidad, where it also attacks the banana. This species is also reported from Surinam. The larvæ tunnel the canes, producing the so-called "dead heart."

Notodontidæ.

Phalera bucephala Steph., the buff-tip moth, in England, is troublesome to many shade and fruit trees, including nuts. It occurs over Europe, except the polar region, Siberia, etc.

Thaumetopœidæ.

A single species, *Thaumetopœa processionea* L., the so-called procession caterpillar of Europe is here to be noted. These caterpillars defoliate oaks, hard wood trees, and even attack field crops, as potatoes, beans, flax, etc. The species is evidently quite important to forests, and is interesting on account of the habits of the larvæ, which, after they are about half grown, return after feeding, to definite localities on the tree trunk, usually a depression or other deformity.

Lymantriidæ. (*Liparidæ*).

To this family belong some of our most notorious injurious insects, namely, the gipsy and brown-tail moths, tussock moth, etc. Here also belongs the famous "nun" moth of Europe, *Lymantria monacha* L. The caterpillars are polyphagous, but especially frequent coniferous and hard wood trees. This species, judging from literature, is one of the highly injurious European insects. The "nun" moth ranges over central and northern Europe, except the polar region, northern Italy, Greece, Japan, etc. Another

polyphagous species is *Porthesia similis* Fuessl. with about the same distribution as *L. monacha*. It is often very destructive to fruit trees. *Euproctis subflava* Brem. is very destructive to fruit trees of all kinds in the Punjab, and probably elsewhere over its range, in Japan, Corea, portions of China, Usuri, etc.

Dasychira pudibunda L. is also a species of unsavory reputation in Europe and widely spread, occurring in central and northern Europe, Japan, China, etc. *Orgyia gonostigma* F. should also be mentioned in this connection and has about the same range as *D. pudibunda*. In New South Wales, *Teia anartoides* Walker is regarded as a serious pest, feeding on Acacias, roses, cherry, etc. *T. contraria* Walker, the bag shelter caterpillar, is reputed to kill stock, the hairs of the caterpillars being eaten in grazing, cause ulcerations of the mucous membranes.

Lasiocampidæ.

Malacosoma neustria L. makes its tents on various plants, as oak, elm, fruit trees, roses, etc., occurring pretty generally over Europe except the polar region, and is present in western Asia, Siberia, China, Japan, etc. *Gastropacha quercifolia* L., spread over Europe, is at times of importance to fruit trees, as is *Pœcilocampa populi* L. and *Odonestis pruni L. Lasiocampa trifolii* Esp., occurs on clover, etc., in Europe and occurs also in England, and portions of Asia Minor.

Noctuidæ.

This large family, as would be surmised, contains many highly injurious forms in different parts of the world.

Charæas graminis L. is from time to time very abundant and destructive to meadows in portions of Europe, the larvæ eating the roots of grasses. It is usually noted in devastating numbers in the mountain districts.

Mamestra composita L., the army worm of New Zealand, seriously injures various grains and grasses. *Dianthoecia compta* occurs over central and southern Europe, and includes in its food violets and carnations. *Diloba cæruleocephala* L. injures cherry, plum and apple in England, occurring also in Europe and Asia Minor. *Hadena brassicæ* L. has a wide range, as Europe, Siberia, Japan, India and South America. *Prodenia littoralis* Bdv. is a serious pest of cotton in Uganda, Cape Colony, and Egypt, and occurs in the Canaries, Asia, Central America, etc. *Gortyna ochracea* Hubn. mines the stalks of Irish potatoes in Ireland, and occurs over central Europe, in Italy, Russia, Corsica, etc. *Nonagria inferens* Walk. bores the stems of rice in Formosa, while *N. uniformis* Dgn. is the cause of much complaint in India during the cold weather from its boring of wheat stems. *N. exitiosa* Oll. is said to be

the most destructive of all pests of sugar cane in New South Wales. *Spodaptera mauritia* Bdv. appears in great abundance on rice and grasses during the rains, or soon after, in India and has also been reported as quite destructive to Batangas rice fields in the Philippines. It is known as a pest also in Borneo. This species also attacks tobacco and vegetables. *Calamistis fusca* Hamp. (generally referred to as *Sesamia*) is a first class pest of corn in the Transvaal, Natal, Cape Colony, Rhodesia, etc., while *Sesamia cretica* Led. is one of the worst of all pests to corn and sugar cane in Khartoum. It ranges over Egypt, southern Europe, Asia Minor, etc. The larvæ bore into the stems of the young plants, later attacking the ears of corn.

Tæniocampa incerta Hbn. feeds on apple foliage and fruit in England; willow, oak and sloe are, however, its normal food plants. The species is distributed over much of Europe, Siberia, etc., and is recorded from North America. Two species of *Xylina*, namely, *ornithopus* Rott. and *socia* Rott. injure plums in Europe and have a wide distribution in the Palearctic region. In India, *Heliothis assulta* injures tobacco. In the same country the green shoots of the egg plant are bored by *Eublemma olivacea* Walk. *Thalpochares scitula* Rmbr. is noteworthy among Noctuids as feeding on scale insects in Italy. *Plusia chalcytes* Esp. feeds on foliage of peas, beans and potatoes in Australia, while *P. agramma* Guen. feeds on Cucurbits in India. *P. nigrisigna* Walk. is also a common pest in India, feeding on lucerne, peas, etc. *Cirphis leucosticha* Hamp. is the East African cob worm and eats the ears of corn, as does our common bollworm (*Heliothis obsoleta*). *Diparopsis castanea* Hamp. is the Sudan cotton bollworm, where it was probably introduced. It is also known from Beira, Delagoa Bay and Uganda. *Sacododes pyralis* Dyar, an allied species of South America, has similar habits. Larvæ of *Ontoptera intricata* Walk. are said by French to be the most destructive of grass-eating grubs known to him. The females lay from 500 to 700 eggs each. Larvæ construct tunnels which they leave at night to feed. *Naranga diffusa* Moor is a pest of rice and grasses in Formosa.

One group, of the Noctuidæ, (*Aphiderinæ*) contains several highly interesting and destructive forms, from the habits of the moths of piercing with their especially adapted probosces, ripe fruits, in order to feed on the juices.

Mænas salaminia Fabr. occurs in portions of Australia, as does *Orthreis fullonica* L. and is further distributed to Africa, India, Ceylon and the New Hebrides. *Argadesa materna* L., *Cosmophila erosa* Hbn., *Egybolia vaillantina*, *Sphingomorpha chlorea*, *Ophiusa lienardi* are other names for fruit piercing moths mentioned in literature as troublesome in Australia or South Africa. *C. erosa* is also recorded from the United States.

Agaristidæ.

A single Agaristid is to be noted. *Phalænoides glycine* Lewis, a serious vine pest in Victoria, where it may have been introduced.

Geometridæ.

Cheimatobia brumata L., known in England as the winter moth, is a fruit pest of importance in Europe. The larvæ feed on most forest trees (except conifers), hedgerows, etc. The insect strongly resembles our American canker worms, the females being wingless. This species ranges over central and northern Europe, southern and western Russia, Greenland, etc. *Chlorolystis rectangulata* L. is the so-called green pug moth, occurring pretty well over Europe. In Ireland it is troublesome to apples. *Abraxas grossulariata* L., the magpie moth, is especially troublesome to the currant, though fruit trees are attacked. Its distribution is very wide, as Europe, Siberia, China, etc. *Hibernia defoliara* Clerck is often damaging to fruit and other trees in Europe and is generally referred to in European textbooks. *H. rupicapraria* Hb. is also of wide distribution, and apparently of about the same importance. *Anisopteryx æscularia* Schiff. is an orchard pest in Europe, and is England is called the March moth. Its usual food is white thorn and black thorn, but it infests oak, elm, maple, etc. *Biston græcarius* Stgr. is a pest of forage plants and occurs in Italy, Greece, Macedonia, etc. *Biston suppressaria* is a caterpillar pest of tea, injuring this plant periodically in India. *Hemerophila atrilineata* injures mulberry seriously in Japan, interfering with the silk industry.

Cymbidæ.

Earias insulana Bvd. is the Egyptian cotton bollworm, or the spotted bollworm of India, causing a yearly loss in the former region of about $5,000,000. It attacks most malvaceous plants. It is recorded from North and South India, Burma, Siam, Australia, Mauritius, Uganda, etc. *Earias faba* Stoll, also known as the spotted bollworm, has similar habits, though in India it is more abundant than the former species. The larvæ bore into cotton bolls and feed on the oily seeds. In the absence of bolls, the shoots are tunnelled. In warmer parts of India the insect may go through its life cycle in about thirty days, and they are active throughout the winter.

Zygænidæ.

Levuana iridescens Bet.-Baker, the coconut leaf moth, has for many years been a destructive insect enemy of the coconut and Royal palm in Fiji. It is apparently yet limited to these Islands.

Sesiidæ.

Sesia myopæformis Bkh. infests the trunk and branches of apple trees in Europe, as does *S. pyri* in North America. *Trochilium crabroniformis* Lewin is injurious to osiers, the larvæ boring the stumps. It is recorded from England, Germany, Austria, etc.

Cossidæ.

Cossus cossus (*ligniperda*) L. bores the trunk, limbs and branches of shade, park and forest trees, as well as orchard trees. According to Taschenberg 266 larvæ were taken from one pear tree, while from 20 to 30, in individual forest trees is usual. The species is widely distributed, as much of Europe, Syria, Korea, etc. A near relative, *Zeuzera pyrina* L. is now established in the United States. *Z. coffeæ* Nietn. bores coffee stems in India, while *Cossus tristis* Drury bores the wood of apple and quince in South Africa.

Hepialidæ.

Hepialis lupulina L., the garden swift moth of England, does great damage to roots and stalks of plants, as well as bulbs and corms. The larvae attack also the strawberry. It occurs over central Europe, Scandinavia, Italy, Dalmatia, etc. *Hepialus humuli* L. is a pest of the hop plant, the larvæ tunnelling the roots. It occurs pretty well over northern and central Europe. Larvæ of *Charagia lignivora* Lewin bore apple-trees in Victoria, while in Australia larvae of *Pielus hyalinatus* and *P. imperialis* live in the roots of trees.

Pyralidæ.

Chilo simplex Butl., *C. zonellus* and *C. partellus* Swimb. are pests of cane, corn, sorghum, grass, etc. in India and Formosa, as is *C. fuscatellus* Sn. in Java. The larvæ bore the stems of the plants. *Diatræa striatalis* Snellen bores sugar cane in Java, like our *D. saccharalis*, and is one of their most important pests. A related, or perhaps the same species, *D. auriflua* Zell. similarly injures cane in India. *Diatræa canella*, *D. lineolata* with *D. saccharalis* injure sugar cane in Trinidad. *Heterographis bengallela* Rag. tunnels the fruit of the custard apple in the region of Calcutta and *Euzophera perticella* Rag. is a wide-spread pest of the egg plant in the plains of India, the larvæ boring the lower stems, while another species, *Leucinodes arboralis* Guen. infests the fruit. *Nephopteryx rubrigonella* Rag. is the pear fruit borer of Japan and is very destructive to this crop. *N. sagitiferella* Moore, similarly bores citrus fruits in Perak and the Malay Archipelago generally. *Phycita infusella* Meyr is widely spread over India, and is known as the cotton bud moth on account of its injuries to cotton. *Nymphula depunctalis*

Dup. is common in India and feeds on foliage of rice. The larvæ make cases of leaves and are able to live either in air or water. *Godara comalis* Guerin, infests, in Australia, the leaves of turnips and horse radish, and in the same country *Conogethes punctiferalis* Guerin, attacks ripening peaches, eating into and webbing over the surface, and pupating at the pit. *Dichochrosis punctiferalis* Guerin is quite injurious to castor beans in India, the larvæ boring into the stems and seeds, often causing much loss. *Pyrausta nubilalis* Hb., ranging over central and southern Europe, Asia Minor, southern India, etc., is destructive to hops in Europe, the larvæ boring the stems of the plants. *Scirpophaga intacta* Sn., in Java, injures sugar cane, the larvæ boring the terminal roll of leaves and also the stem. *Sylepta derogata* Fabr. and *Phycita infusella* Meyer, are both cotton pests in India, the former feeding on the leaves, which it rolls, and the latter on the buds of the shoots, folding the young leaves together, which renders its detection easy. *Glyphodes indica* Saund., which much resembles our melon caterpillar, has in India about the same habits, the larvæ defoliating melon and allied plants. *Micromima olivia* in Cuba rolls and eats the leaves of tobacco in the seed beds, attacking also the egg plant.

Tortricidæ.

This family contains some of our most destructive insects and species of importance in other countries should be looked upon with suspicion.

Omphisa anastomosalis Guen. is quite destructive to sweet potatoes in Formosa and has recently been introduced (1900) in Hawaii, the larvæ boring the roots and tubers. *Capua angustiorana* Haw., the small apricot and vine moth, is destructive to these crops in England. It occurs over central and western Europe, in Asia Minor, northwest Africa, etc. *Tortrix excessana* Walker, native to New Zealand, injures the foliage and fruit of the apple, the latter being tunnelled in all directions, and for this reason is known by some as the railway bug. *Tortrix ashworthana* Newm. (= *Cacœcia responsana*), in Victoria, bores into apple much like our *Carpocapsa pomonella*, with which it has been confused. This is regarded as a serious pest by reason of the character and amount of damage to apples. *Tortrix divulsana* Walker, (= *Tortrix glaphyrana*), the lucerne moth, is a regular pest in New South Wales, the larvæ feeding on and webbing together the tips of its food plant. *Pandemis ribeana* Hb., P. *heparana* Schiff. *P. podana* Sc. and related species in England infest various orchard trees often seriously. These are insects of wide distribution in the Palearctic region. *Clysia ambiguella* Hb. is one of the first class pests of grapes in France at the present time, the larvæ eating the blossom clusters, and later

boring into the berries. This pest has a wide distribution over Europe, except in the polar region and occurs in Asia Minor, India and Japan. Two species of *Olethreutes*, namely, *cynobatella* L. and *pruniana* Hb., are worthy of mention as injuring buds, young leaves and blossoms of orchard trees in various parts of Europe, working much like the bud moth, *Tmetocera ocellana* Fabr. now well established in the United States. *Polychrosis botrana* Schiff. corresponds to our grape berry moth *Polychrosis viteana* Clemens, and it was long supposed that ours was the European species. This latter ranks as a vine pest in Fance with *Clysia ambiguella*, earlier mentioned, and is widely distributed over southern Europe. *Notocelia roborana* Tr. infests currant fruit in England, at times seriously, the larvæ hollowing out the ripening fruit. It ranges over Europe, except the polar region. Several species of *Laspeyresia* (*Grapholitha*) in Europe are troublesome insects and would probably prove very undesirable introductions in the United States. Larvæ of *L. woeberiana* Schiff. bores the bark of cherry, plum, apple and peach trees. *L. funebrana* Tr., the red plum maggot of England, attacks fruit of plum in England and in the caterpillar state is said to be plentiful in plum pies. It would doubtless be very damaging to our prune industry on the Pacific coast. It occurs over central Europe, Scandinavia, Italy and Asia Minor. *L. dorsana* F. has about the same distribution and is of importance by reason of its injuries to peas. *Laspeyresia schistaceana* Sn. is an important sugar-cane pest in Java, the larvæ boring into the more tender shoots. *Carpocapsa splendana* Hb. is a serious pest of walnut and chestnuts in Europe. The normal food is said to be acorns. It occurs in central and southern Europe, Sweden, England, etc. *C. amplana* Hb. infests hazel nuts, walnuts, etc., etc.. occurring in Germany, Austria, northern and central Italy. The so-called Natal codling moth, a species of *Carpocapsa*, is a serious enemy of guavas, oranges and mandarines in that country. *Simæthis nemorana* Hb. infests figs, and occurs in southern Europe, Asia Minor, Madeira, Mauritius and is reported from Canada. *Paramorpha aquilina* Meyrick has come into notice as an orange pest in Australia. The larvæ bore through the skin and feed on the pith between rind and flesh. *Crytophaga unipunctata* Donovan is the cherry borer of Australia. The larvæ are said to be excessively destructive to cherry and peach trees, and some times to plums. Galleries are eaten under the bark, the larvæ later boring into the heart of the tree. *Amorbia emigratella* Busck, thought to be native to Mexico and Costa Rica, has recently appeared in Hawaii and is known as the leaf roller of sweet potatoes. It also attacks many kinds of shrubs and fruit trees.

Yponomeutidæ.

A few forms in this family require mention. *Yponomeuta malinellus* Zell. *Y. evonymellus* L. and *Y. padellus* L. are recognized as of considerable importance to orchardists in England and portions of Europe, especially the first mentioned, which has just made its appearance in the United States near Geneva, N. Y. *Y. padellus* feed on plum and cherry in France, and on plum in Italy. *Prays citri* Mill. infests the orange in Corsica, Sicily, Ceylon and Australia, and recently it has been received from the Philippines. *P. oleelus* F. injures foliage of olive in Italy, and ranges over the Mediterranean region, where the olive is cultivated. In the genus *Argyresthia* are several suspicious characters. *A. conjugella* Z. is already established in British Columbia and has been taken in the Puget Sound region in Washington State The slender larvæ tunnel apples and other fruits. It ranges over central and southern Europe, Asia Minor, Japan, etc. *A. nitidella* Fabr. is the cherry fruit moth of England, the larvæ burrowing in the fruit. *A. ephippella* F. feeds on the shoots of cherry, the leaf and blossom buds of wild plum, also on the hazel. *A. cornella* F. attacks the leaf buds of apple.

Gelechiidæ.

Gelechia gossypiella Saund. is another serious cotton pest and is almost universally distributed over India, Ceylon, Burma, Straits Settlements and East Africa. It has just now been found in Hawaii. It is known as the pink bollworm, and is generally associated with the spotted bollworms. The larvæ also bore into the bolls and feed on the oily seed. *Anacampsis nerteria* Meyr. is injurious to ground nuts in Ceylon and South India, and is apparently quite important. *Anarsia ephippias* Meyr. also feeds on the ground nut in India and has been taken only during the rains. It feeds upon and rolls the leaves together.

Elachistidæ.

The pith moths, *Blastodaena hellerella* Dup., and *B. vinolentella* H. S. are insects whose larvæ cause a good deal of damage to apple trees, especially nursery stock. The larvæ bore into the buds, spurs and shoots, thus causing the foliage and shoots to die. The species work something like our *Epinotia pyricolana* Murtf. *Antispila rivillei* Stt. injures grape foliage like our *A. isabella* and occurs in northern and middle Italy and Dalmatia. *Coleophora anatipennella* Hbn. the cherry case bearer, injures cherry buds in the spring time in England and occurs over central and northern Europe. *C. flavipennella* HS. injures pears in Europe in a similar way, while *C. hemerobiella* Z. feeds on apple, pear and cherry,

Blastodaena atra Haw. is the apple fruit borer of Japan and is one of their most troublesome pests.

Lyonetiidæ.

Lyonetia clerkella L. mines apple leaves in Europe, but is not especially important on account of the character of injury. The species occurs over central and northern Europe, central Italy, Sardnia, etc. *L. prunifoliella* Hb. similarly mines plum and cherry leaves, and has a wider distribution than the former. *Cemistoma scitella* Z. mines apple and pear leaves, occurring over central and northern Europe, Dalmatia, Italy, etc. *Cemistoma coffeella* Perrottet is the coffee leaf miner of the West Indies. It has been introduced into Brazil and other coffee growing regions of the Western Hemisphere and does much damage to this crop. In Porto Rico, for example, it was held to have caused a loss of from $150,000 to $300,000 during 1904.

Tineidæ.

Incurvaria rubiella Bjerk., known as the raspberry moth in England, is important, the larvæ boring the shoots, thus lessening or destroying the crop. It is present in central and northern Europe, Corsica, Dalmatia, Russia, etc. *Incurvaria capitella* Clerk injures the fruit and shoots of the currant and ranges over central Europe, Norway, Sweden and Western Russia. *Gnorimoschema heliopa* Lower is a serious enemy of tobacco in India, Ceylon and Java, the larvæ boring the stems, causing gall-like swellings. *Ereunetis flavistriata* Walsm., is the Hawaiian sugar-cane bud moth, the larvæ also eating the dead leaves of palms, bananas, pineapples, and sometimes eating the skin of the banana fruit. The peach moth of Japan, *Carposina persicæ* Sasaki is one of the very destructive insects of this crop, more than 90 per cent being injured during some seasons.

DIPTERA.

Tipulidæ.

Several species of this family are referred to in European literature and are evidently of considerable importance. The larvæ of *Tipula oleracea* L. injure various root crops, as well as those of *T. paludosa*. *Pachyrhina maculosa* Meig. has a record of serious injury to tulip bulbs in England.

Cecidomyiidæ

Dasyneura anophila Haimh. is a gall maker on grape foliage, occurring in central Europe and the Mediterranean region. *D.*

pyri Bouché, the pear leaf curling midge is distributed over central and northern Europe, though it has as yet attracted but little attention by its injuries. *Asphondylia lupini* Silv. injures lupines in Italy, the maggots infesting and aborting the seed pods. This species was reared from its host by Coquillett at Los Angeles. *Mayetiola avenæ* March. injures wheat in southern Europe much like its cogener, *M. destructor*. *Contarinia nasturtii* Kieffer, the so-called "swede midge," infests swedes in Ireland, the maggots occurring at bases of leaf stalks. It occurs on various cruciferous vegetables in Europe. *C. gossypii* Felt infests the flower buds of cotton, causing the bracts to flare and squares to drop. This pest appeared in Antigua in 1907, and caused very serious losses at the time. It is apparently still confined to that Island. *Cecidomyia oryzæ* Wood Mason has been destructive to rice in Bengal. *Parricondyla gossypii* Coq. is a pest in Barbados, and is present in Montserrat. The red maggots occur under the bark of the stems of the cotton plant, which they may completely girdle, causing the death of the portion above the infested area.

Bibionidæ.

The larvæ of *Bibio hortulanus* L. live on the roots of various garden and other crops in Europe, the species also occurring in northern Africa and Asia Minor.

Syrphidæ.

The Narcissus fly, *Merodon equestris* Fab., in Europe, is injurious to bulbs of narcissus, daffodil and amaryllis. The species is now well established in British Columbia.

Anthomyidæ.

We have already received from Europe several of the injurious species of this family and other forms are yet to be introduced. *Pegomyia hyoscyami* Panz. infests the foliage of garden vegetable as beets and spinach, though apparently it is not of great importance at the present time. *P. betæ* Curtis, in England, is noted as of increasing economic importance and is just now doing a good deal of injury to beets. The larvæ attack the mesophyll of the leaf. There are two or even three broods each year.

Trypetidæ.

The Trypetid family of flies is one of almost world-wide distribution and contains many species of the greatest economic importance, as the so called fruit flies. These are especially destructive for the reason that thus far no remedies have been developed which

are of much value in lessening attack. With the exception of the *Rhagoletis pomonella*, no species is as yet notably destructive in the United States, though the notorious Mediterranean fruit fly, *Ceratitis capitata*, is well established in the Territory of Hawaii. Other dangerous forms are in the West Indies, some of them perhaps already established in South Florida. The family is especially rich in species in Africa, the East Indies and Australia, and in the latter country constitute a veritable scourge to certain crops.

Ceratitis capitata Wied., is now pretty well distributed over the tropical and subtropical parts of the old world and occurs in Australia, South Africa, Brazil, Burmuda, Hawaii, etc. It infests practically all soft fruits, and numerous sorts of vegetables. It is notably injurious to peaches, oranges and guavas, but infests several dozen other fruits, vegetables and wild fruits. *Ceratitis anonæ* Graham injures guavas and the sour sop, in West Africa, while *C. punctata* Wied. injures pods of the cacao in the same region. *C. catoirei* Guerin, considered by some identical with *capitata*, infests oranges in Mauritius. *C. rubivora* Coq., the Natal fruit fly, injures all sorts of cultivated fruits and is extending its range over South Africa. It apparently ranks as a pest close with *capitata*.

The genus *Dacus* also contains a consideration number of forms highly destructive. *D. tryoni* Froggatt, the Queensland fruit fly, infests the banana, mango, peach, nectarine, orange and most other fruits. It is evidently a pest of first importance and ranges from India and Ceylon to Java, Amboina and Australia. *D. ferrugineus* Fabr., the mango fruit fly, also infests oranges, mangoes and other soft fruits and occurs in India, Java and probably many of the Islands of Malaysia. It is thought to have been recently introduced in the Philippines. *D. cucurbitæ* Coq., the melon fruit fly of India, Ceylon and Hawaii, infests most disastrously cantaloupes and watermelons in its range of distribution. *D. bipartitus* Graham, a West African species, attacks especially curcubits, though it is not regarded as a serious pest as yet. *D. persicæ* Bigot, the peach fruit fly of India is very injurious to peaches, oranges, mangoes, etc. *D. psidii* Froggat is the South Sea guava fly, and is known from Fiji and New Caledonia. The Sudan fruit fly is also a *Dacus*, the species not yet having beein dermined apparently. *Dacus oleæ* Rossi is an old time enemy of the olive in the Mediterranean region, including northern Africa and the Canary Islands. It is one of the prime pests of the olive in its territory. The Baluchistan fruit fly, *Carpomyia pardalina* Bigot, is also a melon pest of importance. *Anastrepha serpentina* Wied. and related species infest guava sapadillos, etc., in the Lesser Antilles, while several species of this genus infest fruits in South America, as *A. striata, fratercula, serpen-*

tina, etc. *Anastrepha ludens* Loew is, of course, the principal pest of orange fruit in certain States in Mexico and was the occasion of the quarantine by California of Mexican oranges. *Trypeta musæ* Froggatt, the Island fruit fly, infests bananas and other fruits in the New Hebrides and has been introduced into Australia. *Acidia heraclei* L. occurs in Europe and Asia Minor, and mines the leaves of celery. *Platyparea poeciloptera* Schrank occurs over central Europe and is destructive to asparagus. The female fly deposits her eggs on the tips of the young shoots, the resulting maggots living beneath the skin and tunnelling towards the base of the plant. It remains to mention a fly of the family Lonchæidæ, *Lonchæa splendida*, present in New South Wales, Victoria, New Zealand and the Pacific Islands, which infests tomatoes, after the manner of fruit flies.

Oscinidæ.

The Oscinidæ include several species which in Europe are exceedingly troublesome to small grains. *Chlorops tæniopus* Meigen causes the affection known as "gout" on account of the swollen condition of the heads. The maggots are especially prevalent in barley, but are common also in wheat and rye. Another species, the *Oscinis frit* L., or frit fly, is especially abundant and injurious over northern Europe, attacking principally oats and barley, and constituing one of the most important pests of these crops. The maggots work in the stems of the host plants, about the level of the ground, causing these to wither and die. Injury by a second brood in the heads of these grains causes a blighting of the grains, producing the condition known in Swedish as "frits" from whence the name.

Oscinis theæ is sometimes injurious to tea in Ceylon, the maggots mining the leaves. A species of *Agromyza* mines the stems of peas in India, while still another form mines the leaves of cruciferous plants.

Coleoptera.

Byturidæ.

A single species in this family is regarded as quite troublesome in England, and occurs in France and Germany, namely, *Byturus tomentosus* Fabr. It attacks raspberries, and the greater part of the fruit is stated often to be injured and made unfit for market purposes. The beetles nip off the blossoms and the larvæ infest and feed upon the fruit. It will be recalled that our species, *Byturus unicolor* Say, infests raspberries in the same way, but is apparently much less important than its European cogener.

Buprestidæ.

Capnodis tenebrionis L., distributed over southern Europe, attacks *Prunus spinosa* L. and various fruit trees, working something like our *Chrysobothris femorata*. *Sphenoptera neglecta* Klug attacks cotton throughout the nothern Nile provinces, the larvæ hollowing out the stems.

A similar (perhaps identical) species, *S. gossypii* Kerr., injures cotton in the same way over the cotton area of India. *S. hypogea* is a serious enemy of peanuts in South India, the larvæ boring into the underground root stalks. *Agrilus grisator* Kerr. bores in lemon trees in the same territory, while the larvæ of *Belionata parasina* Thunb. is also common in India and bores the trunks of guava and mango plants. Small leaf-mining Buprestids, *Aphanisticus consanguineus* Rits. and *A. krügeri* Rits. attack sugar cane in Java, though the injuries have not been very important up to the present time.

Bostrychidæ.

Dinoderus minutus Fabr. is common in the bamboo in India, and has been reared from cut sugar cane. *Rhizopertha collaris* Erichson bores into the limbs and branches of the apple in Australia, and is regarded as quite troublesome. *Bostrychopsis jesuita* Fabr. is the orange and fig borer of Australia, though it attacks also lemon and apple. The female places her eggs just beneath the bark, and the larvæ tunnel the hard wood mostly longitudinally. On account of its borings, it has been called the augur beetle.

Scarabaeidæ.

An important European member of this family is the *Melolontha melolontha* L., the common cockchafer, or May-bug. It is injurious in both the larval and adult stages, the grubs feeding on the roots of grasses, vegetables and young trees, and the adults upon foliage of elm, oak, etc., often completely stripping the trees. Most European works on practical entomology give this species extended attention, perhaps more on account of its commonness than its real importance as a pest. In India, *Anomala varians* Oliv. is injurious to rice and other cereals, the larvæ feeding on the roots. *Anomala vitis* Fabr. injures the grape in Europe, Algeria and Tunis, the adults feeding on the foliage and the larvæ on the roots of the plant, and also on roots of various grasses. One of the very troublesome sugar-cane pests of Porto Rico is a species of *Lachnosterna*, the grubs of which devour the roots of the plant. The control of this insect is one of the acute problems before the sugar-cane planters of the Island. *Ligyrus bituberculatus* Beauv.

is of interest by reason of its attacking bananas in certain islands of the West Indies. The grubs tunnel the roots of the banana plant, and their injuries are apparently important.

Phytalus smithi Arrow is destructive to sugar cane in Mauritius where it has evidently been introduced from Barbados, its native home. On one occasion 1,372,000 beetles were captured by the natives, who placed small branches in the ground upon which the beetles climbed. *Holotricha vidua* is reported as the most destructive enemy of sugar cane in the Philippines and has necessitated the abandonment of certain fields. In India, Ceylon, Straits Settlements, Philippines, etc., *Oryctes rhinoceros* L., eats into the soft tissues of young palms, often killing the trees. *Diphucephala colaspidoides* injures fruit trees in Australia, especially cherry. The beetles come from the ground about "cherry time" and often in such countless multitudes as to strip a good sized tree in a very few minutes. *Apogonia destructor* R. Bos., as well as a related species, *A. ritsemæ* Sharp, are destructive pests of sugar cane in Java, injuring the roots of the plants like *Lachnosterna* sp. in Porto Rico. *Heteronychus morator* F., in the adult stage, attacks the young cane at the base in Java, often boring in the canes. *Xylotrupes gideon* L. also bores sugar cane in the Straits Settlements. *Anisoplia austriaca* Herbst., in Austria, Hungary and southern Russia, is one of the very troublesome Scarabids attacking cereals about blooming time, destroying the heads.

Cerambycidæ.

Xylotrechus quadripes Chevr. is a serious enemy of coffee in Southern India, Assam, Sylhet and Burmah, the larvæ boring the stems of the plant, especially those shaded. *Caloclytus annularis* Fabr. injures the bamboo, the larvæ destroying the plants by their borings. *Calamobius marginellus* Fabr. is a European species which injures wheat. The adult oviposits below the head which the resulting larva injures. *Batocera rubus* L., occurring in southern India and Ceylon, is one of the large beetles found throughout the plains, the larvæ being common under the bark of felled trees. The beetles penetrate the trunk of young coconut trees and there deposit eggs, the grubs eating to the top, thus destroying the leaves. The mango is also injured. This species has been recently introduced in Barbados, where its is doing considerable injury. An allied species, *Melanauster chinensis* Forst, is very injurious to fruit trees in Japan and China. *Apomecyna pertigera* Thoms. and *A. histrio* F., are common insects on cultivated crops in India, the former attacking cucurbits. *Acanthophorus serraticornis* Oliv. bores the mango in southern India, while *Plocoderus obesus* Gah. infests Sal wood, the larvæ making large cocoons apparently of

calcium carbonate. *Uracanthus acutus* Blackl. injures peaches apricots and plum in Australia. *Steirastoma depressum* L., the cacao beetle, is the most serious pest of cacao in the West Indies, and the Guianas the larvæ living under the bark of the tree, and also boring the heart wood. *Diploschema rotundicolle* Serv. bores the orange in Brazil and is evidently a serious enemy of this plant. *Apriona rugicollis* Chevr. is a mulberry pest in Japan. The females oviposit on the branches, the larvæ boring into the wood. Three years are required for the life cycle.

Chrysomelidæ.

In this family are quite a number of injurious forms in different parts of the world. The group ranks close to the Curculionidæ in economic importance. *Lema flavipes* Suffr. is injurious to rice in Japan, in both the larva and adult stages. *Hispa callicantha* Bat. also injures rice in the same country, both adults and larvæ feeding on the foliage. *Crioceris merdigera* L., cogeneric with our asparagus beetles, is distributed over all Europe and is a decided pest of lillies in France, both the larvæ and adults feeding on the foliage, the former protected by their excrementitious covering. *Pachnephorus bretinghami* Jac. and *P. impressus* Ros., replace, in India, *Myochrous* in America. They are quite injurious to the young shoots of sugar cane and to cereals. *Chrysochrous chinensis* Baly injures the sweet potato in Formosa. *Galerucella tenella* L. is common over Europe and attacks the strawberry, though not as yet important apparently. *Galeruca semipullata* in Australia, infests wild and cultivated figs, the dirty yellow larvæ feeding on the leaves. *Chætocnema concinna* Marsh, of Europe, is a pest of hops, the beetles defoliating the plants, attacking also the shoots. *Chætocnema basilis* Baly is a rice flea beetle in India, and other species injure various crops. *Haltica ampelophaga* Leesb., the grape flea beetle of Europe is one of their more important vineyard pests. *H. indigacea* Illig. in Cape Colony, is injurious to buds and foliage of fruit trees in spring.

Hispa œnescens By. is a very important rice pest in India. *H. modesta* We. has been reared from sugar cane in the same country. *Leptispa pygmœa* Baly attacks rice in Malabar. *Brontispa froggatti* Sharp, the palm leaf Hispa, injures the foliage of its host plants in New Britian and Solomon Islands generally.

Scelodnota strigicollis Mots. is a pest of grapes in India. Its habits are thought to be like those of our *Fidia viticida*. *Odontionopa sericea* Gyll., in South Africa, injures buds and leaves of fruit trees in the spring.

Aulacophora hilaris Bvd. is a serious pest of cucurbits in Australia, where it is known as the banded pumpkin beetle. This, or

a related species (*olivieri*) is considered the worst leaf-eating pest with which gardners have to deal, attacking also the fruit of the cherry. Another species, *A. forcicollis* Kuest. is a cucurbit pest of importance in Formosa, India, etc. and, *A. exacavata* Baly is present along with the former, and has about the same habits.

RHYNCHOPHORA.

Among the Rhynchophora are to be listed very many of the worst insect pests of the world, and the number of species to be noted in the present connection is relatively large.

Anthribidæ.

The apple beetle of Australia, *Doticus pestilens* Oliff, falls here. It is supposed that eggs are laid in the young fruit. The grubs live in the apples, which, after about a month, shrivel and dry and remain hanging on the trees. The stages of the insect are passed in the fruit, the beetles coming out in the spring, ovipositing in the young fruit.

Curculionidæ.

Several species of *Otiorrhynchus* are to be mentioned. *O. sulcatus* F., native to northern and middle Europe, is now present in New Zealand, Australia and South Africa. It injures both the roots and foliage of strawberry and raspberry plants. *O. corruptor* Host occurs in Italy and attacks the foliage of the grape and almond. *O. singularis* L. is a pest of raspberries in Europe. The beetles eat the fruit buds, blossoms and foliage and gnaw the bark of tender shoots. The grubs feed on the roots of the raspberry and various other plants. *O. lævigatus* Fabr., occurring over middle Europe, is injurious to buds and shoots of plum, and *O. ligustici* L. in central and southern Europe, attacks grape, peach and hops, etc., injuring the leaf and fruit buds, as well as the shoots. Several other injurious forms in the genus ought to be mentioned. *Pachneus litus* and *P. azurescens* are serious orange pests in Cuba, the larvæ feeding on the roots of the plants. *Phyllobius maculicornis* Germ., *P. oblongus* L., *P. pyri* L., occurring over Europe, attack various fruit trees, as well as *Fagus, Quercus*, etc. *Barypithes araneiformis* Schrank, present in central Europe, injures strawberry by eating holes in the green and ripe fruit. *Sitona lineata L.*, distributed over Europe, and *S. sulcifrons* Thunb, attack the shoots of peas as they are pushing through the ground, and later, the foliage. *Cleonus luigionii* Motsch. present in central and southern Italy, is quite injurious to the beet, the larvæ boring the roots. *Liparus coronatus* Geoze, is destructive to carrots in a similar way. *Phytonomus variabilis* Herbst. attacks species of

Medicago, the larvæ feeding on the foliage. The species is present over Europe. *Euscepes batatæ* Waterhouse, the so called "scarabee" or "Jacobs" of the West Indies, is a very important pest of the sweet potato, the tubers of which the larvæ tunnel. It is also present in Hawaii. *Cryptorhynchus gravis* Fabr. is the mango weevil of eastern Bengal and Assam, while *C. mangiferæ* Fabr., is the common species in South India and Ceylon. Mango weevils are, without doubt, the most serious pests of the mango in oriental countries. The latter species is said now to inhabit all the mango regions bordering the Indian Ocean, and adjacent islands, and occurs through the East Indies, the Philippines and other groups of South Pacific Islands. It is present in South Africa, Madagascar and other places. *Ceutorrhynchus pleurostigma* Marsh, ranging over Europe, is destructive to cruciferous plants, as is also *C. assimilis* Payk, of similar habits. Another species, *C. napi* Gyll., is also injurious to cabbage. Two species of *Baris* also attack cabbage, namely, *B. cuprirostris* F. and *B. chlorizans* Germ. *Rhynchophorus ferrugineus* F. is the red palm weevil of India and Ceylon, infesting the toddy and coconut palms. The eggs are placed at a wound or cut in the soft tissues at base of leaf sheath, the larvæ tunnelling through the tissues in all directions, making a cocoon of twisted fibres. *R. palmarum* L. is the palm weevil of Brazil, Cayenne, Surinam, the West Indies, and probably occurs on tropical coast of South America generally. The palm weevil is recorded as also attacking sugar cane in Trinidad. *R. cruentatus* Fab. occurs in Florida.

Sphenophorus obscurus Boisd. is the destructive sugar-cane borer in Tahiti, Hawaii, New Guinea, Fiji, etc., It is widely spread but is not on the mainland of the United States. It also attacks the coconut. The female enters between a leaf sheath and the stem. A small cavity is cut with the mandibles, in which an egg is placed. The resulting grub tunnels upward in the cane, making occasional apertures to the exterior. *S. sericeus* Oliv. is a well known enemy of sugar cane in the West Indies, where it is designated the weevil borer. *S. sordidus* Germar injures the banana in the West Indies and is especially complained of in Fiji. The young suckers are attacked and quickly killed by the larvæ boring in the base of the plants. It is said to occur from the South Pacific Ocean to the Islands of the Indian Archipelago.

Balaninus nucum L., the nut weevil of Europe, is commonly injurious to the filbert, cob and wild hazelnut. Other species present in Europe are of more or less importance, as *B. cerasorum* Hbst., attacking sour and sweet cherries, and *B. elephas* Gyll., attacking chestnuts.

On of the weevils of Europe which has not yet reached the United States, and which is without doubt a first class pest of the apple is

Anthonomus pomorum L. The female deposits eggs in unopened flower buds and blossoms of the apple. Its injuries were recorded as early as 1801, and there is now a considerable European literature on the species. Cold, damp weather, retarding the opening of apple blossoms, is said to be quite favorable to it. The symptoms of injury are the scorched appearance of the blossoms, and their failure to open normally.

A. rubi Herbst., in Europe, injures the raspberry in about the same manner as the foregoing. The weevils of the new generation puncture the shoots and feed on the foliage. *A. rectirostris* L. attacks stone fruits in Europe, especially cherries. The grub infest the pits or seeds like our *Coccotorus prunicida* apparently. The cotton square weevil of Peru, species of *Anthonomus*, probably *vestitus* Boh. injures cotton in a way similar to *A. grandis*. *A. varipes* DuVal injures the egg plant in Cuba, the beetles feeding on the tender buds. *Magdalis* is well represented in Europe by species occurring on useful plants. *M. armigera* Geoff. infests branches of plum trees. *M. barbicornis* Latr., the branches of apple, quince etc. *M. cerasi* L., cherry and plum; *M. duplicata* Germ., pear; *M. ruficornis* L., various orchard trees, and *M. violacea* L., the pear. *Apion apricans* Hbst., of Europe, attacks red and purple clover. Eggs are placed in the blossom heads, the larvæ eating the unripe seeds, reducing seed production. There are several broods each year. *Rhynchites cæruleus* DeGeer oviposits in tender shoots of apple, and then cuts off the twig just below the point of insertion of the egg. Considerable injury is thus done to young growing trees. The insect occurs over Europe. *R. ruber* Fairm, occurring in Greece, Corsica, Crete, etc., is a very local species, but which is quite a pest of the olive. The female oviposits in the fruit in which the grubs feed much like our *Conotrachelus nenuphar*. Other species of *Rhynchites* are of more or less prominence in Europe to one plant or another, as *R. bacchus* L., *cupreus* L., *interpunctatus* Steph., etc. *Byctiscus betulæ* L., distributed over Europe, Asia, Siberia, etc., injures numerous plants in its range, and is especially likely to attack the grape. *Diaprepes abbreviatus* is present generally throughout the West Indies, where it is destructive to sugar cane, especially in parts of Barbados. *Rhinaria perdix* Pascoe is a serious enemy of strawberry in Victoria and Tasmania, and to a less extent, raspberries. Both adults and larvæ are destructive, though the larvæ more so as they feed on the central "bud" of head of the plant, thus often killing the plants outright. *Rhadinosomus lacordairei* is said to be the worst insect enemy of strawberries in Tasmania, and occurs in all of the Australian States, and perhaps in New Zealand. Another Australian pest is *Leptops hopei* Fahrs., which is said to be one of the most troublesome insects of Victoria, attacking especially apples and pears. Eggs

are laid in batches on the leaves, and the grubs crawl down in the soil and feed on the roots in which they cut galleries and furrows, often largely devouring them. *Metatyges turritus* Pasc. is quite injurous to figs in Natal and the east coast generally. Eggs are laid in the fruit in which the grub feeds. The species is two-brooded. *Echinocnemus squameus* Billb. is a rice pest in Formosa, the larvæ feeding on the roots. A species of *Phylaitis* bores the stems of cotton in South India and Behar, fron the effect of which the plants become weakened, break off and die. *Orthorrhinus klugi* Sch. is injurious to grape in Australia, the larvæ hollowing out the canes. Another species of the same genus, *O. cylindrirostris* Fabr., is a pest of the orange. The eggs are laid in the bark of the tree, a foot or so from the ground, the larvæ boring into the wood in all directions. The tomato weevil of Victoria, *Desiantha nociva* Lea, has attracted some attention on account of its injuries to tomato. Certain species of *Belus* are regarded in Victoria as serious enemies of the apricot. Adults bore holes in the branches in which the eggs are placed, the grubs tunnelling the branch, thus killing the trees. The species mentioned are *B. bidentatus*, *B. suturalis*, *B. irroratus*, *B. centralis* and *Belus sp.*

HYMENOPTERA.

Tenthredinidæ.

Allantus cinctus L., distributed over Europe, infests normally the leaves of the rose, wild and cultivated, and is known to attack the raspberry. The prepupal larvæ hollow out the canes, where also they pass the winter, transforming in the spring. *Athalia spinarum* Fabr., occurring in Europe, Algeria, etc., is injurious to the turnip, beet and cruciferous plants, destroying the foliage. *A. proximata* Klug, in India, feeds on cruciferous plants generally and is one of the commonest species of the plains.

Two species of *Hoplocampa* are troublesome pests. *H. testudinea* Klug occurs over central Europe, and is quite injurious to apple in portions of England. The females oviposit in the apple blossoms, the larvæ boring into the young fruit, which later fall. A related, and perhaps identical species, is already established in Washington State, and in British Columbia. *H. fulvicornis* Panz. also ranging over central Europe, attacks the plum after the same manner, and is a pest of importance in England.

Pteronidea leucotrochus Htg. is injurious to gooseberry, the larvæ eating the foliage like *N. ribesii* and is spread over central and northern Europe. *Priophorus padi* L., the plum saw-fly, ranges over central and northern Europe, the larvæ feeding on the foliage, also attacking pear, rose, hawthorn, etc. *Diprion pini* L., distrib-

uted over central and northern Europe, defoliates the pine, as its name indicates, to which at times, it is quite destructive. *Arge rosæ* L. is a rose pest widely spread over Europe, and occurs in Siberia and Asia Minor.

Janus compressus Fabr., of central and southern Europe,deposits its eggs in the buds of the pear, which the larvæ hollow out, and later eat their way into the twig, tunnelling along the pith. *Pamphilius flaviventris* Retz is distributed over western Europe. It is known in England as the social pear saw-fly. Eggs are placed in groups of from 30 to 60 on under-surface of pear leaves. The young larvæ at once commence to form a web, which is added to as they grow, sometimes reaching a length of a foot. The larvæ also feed upon plum, cherry, white thorn and other rosaceous plants.

The author wishes to acknowledge the assistance of his colleagues, Messrs. Schwarz, Dyar, Busck, Caudell, Heidemann, Knab, Rohwer and others in connection with questions of nomenclature in the orders in which they are respectively specialists.

Commenting on Professor Quaintance's address, Mr. Marlatt said that he had been much interested in the presentation made, and that the subject was most timely in view of the recent enactment of the plant quarantine law which now furnishes, for the first time in the history of the United States, a means of excluding foreign insect pests. It is therefore of especial importance just now to make available a publication which will give descriptions and, so far as possible, illustrations of all known important foreign insect pests, for the guidance of state inspectors and others engaged in plant quarantine and inspection work. He said that he believed Dr. Howard had in view the preparation of a comprehensive bulletin covering this general subject, and that it was to be prepared with the aid of the many experts which Dr. Howard had as his assistants in the Bureau of Entomology. Such a publication, prepared with the aid of these experts and edited by Dr. Howard, should have a comprehensiveness and value which would make it of great usefulness.

The inspection of plant material imported by the Department and other imported plant stock coming to the District of Columbia, largely under the expert management of Mr. Sasscer, has shown that much of such imported stock is infested, and the comparison

of the findings made from the local inspection referred to with that of state inspectors shows the great value of the wider acquaintance which the Bureau inspectors have with foreign insect pests. Necessarily most state inspectors are little acquainted with foreign pests, and have expert knowledge only of the common insect and fungous pests of this country. A publication, therefore, for which Professor Quaintance's address may furnish the basis, is very much needed.

The classification of foreign injurious insects would perhaps be more useful to the inspectors and quarantine officers if it were based on countries and food plants. The inspector, then, knowing the country of origin and the character of the plants, could determine at once the known injurious insects which he would have to be on the watch for. A systematic classification of such insects could also be included, following the plan adopted by Professor Quaintance.

Mr. Marlatt added that a publication of this kind must necessarily be based on known injurious insects. It should not be overlooked, however, that the injuriousness of an insect in a foreign country (and this, was alluded to by Professor Quaintance) is not necessarily a measure of its possible economic importance if established elsewhere. The San Jose scale, for example, as found by Mr. Marlatt in northeastern China, was an insect of little importance on native plants and fruits, presenting a very scattering and insignificant infestation. The wide horticultural exploration conducted later by Mr. F. N. Meyer in northern China and Manchuria resulted in his importing quantities of fruit twigs and trees for the Department of Agriculture. Much of this material was infested with the San Jose scale, but most scatteringly and giving no indication whatever of the tremendous power of damage which this scale insect has developed in this country. Many other illustrations of the same sort will occur to most entomologists, and they simply emphasize the need of not only looking out for the known injurious species, but making the most careful inspection to detect any new form, however unimportant it may appear on the imported plants. This is particularly true of all plant stock imported from countries which have not been in close commercial relationship with this country and Europe. Practically all the scale insects,

in addition to the San Jose scale, and other pests found on the plants just referred to as imported from northern China and Manchuria proved to be new, and therefore with unknown potentialities for injury. This condition is also likely to be true of South American, African, and most Asiatic countries. Inspectors should therefore be especially vigilant in the examination of stock from such countries.

Appreciating the special danger from such countries the Federal Horticultural Board, in the revision of its regulations, has very greatly restricted the importation of plants from all countries which cannot or do not have an adequate system of plant inspection and certification. This practically limits free importation to European countries and European colonies which have well established entomological and plant pathological bureaus. From Asiatic and other countries where inspection is not possible the importation of plants is limited to small amounts, and these are to be held at the port of entry until thoroughly inspected and passed by federal inspectors, the provision being intended merely to furnish a means of entry of new and valuable fruits or ornamental plants.

Mr. Marlatt extended his hearty congratulations to Professor Quaintance for the comprehensive and excellent manner in which he had covered in his address the field of foreign injurious insects.

Dr. Howard stated that he had listened to Professor Quaintance's address with considerable interest and hoped the paper would be published in full. He made a few remarks on the work of insects in other countries and spoke of discussions which he heard at the International Congress of Zoölogy in reference to the quarantine law recently passed in this country. He mentioned a talk by Mr. Rogers of the Board of Agriculture and Fisheries of Great Britain, who seemed to be of the opinion that the United States should accept the observations of experts in foreign countries before taking any action along quarantine measures, but our distinguished colleague, Dr. S. A. Forbes, soon showed the fallacy of his comments.

After remarks by President Busck on the capable manner in which Professor Quaintance conducted the meetings as President during the year, Mr. Schwarz moved that the Society extend to

Professor Quaintance a vote of thanks for the efficient manner in which he managed the affairs of the society and for his timely and most interesting address. Carried.

Mr. Gahan presented the following paper:

SOME NOTES ON THE PALPI OF APHIDIINÆ.

By A. B. Gahan, *Maryland Agricultural Experiment Station.*

In a previous communication before this Society, the writer called attention to certain variations in the number of antennal segments in various species of Aphidiinæ. Among other species studied with regard to this variation was *Diaeretus rapæ* Curt., the common parasite of *Aphis brassicæ*.

Recent study of the same species has brought to light another and more surprising variation, this time in the number of segments in the maxillary palpi. While apparently the palpi are more frequently four-segmented than otherwise, in a series of one hundred and fifty or more specimens there appear to be almost as many in which they are distinctly three-segmented. Not only is this true but several specimens were observed in which one palpus was plainly four-segmented while the other had but three complete segments.

In cases in which the number of segments differs in the two palpi of the same individual, it is apparent that the difference is due to an imperfect separation of the third and fourth joints in one palpus. The point at which the division should have occurred is usually indicated by a more or less distinct notch on one or both sides of the segment. In specimens having both palpi three-segmented, usually no such notch is present but the third segment is generally, though not always, somewhat more elongate than is the case in the four-segmented palpi.

That this is really a variation within the species seems certain, since a small series of specimens, all the progeny of a single female, shows individuals having three-jointed palpi as well as others in which the palpi are four-jointed. That it is not merely an accidental variation is proven by the fact that in several large series of specimens reared from the cabbage aphis on widely different dates the same variability occurs.

Both sexes vary alike and in about the same proportion, so that the differences are in no sense sexual.

In view of the fact that some importance has been attached by Haliday, Marshall and others to the number of palpal segments, in the classification of the Aphidiinæ, it is of some interest to know whether the same variability occurs in other species and genera of

the group. With a view to the determination of this point, series of specimens (in each case numbering over ten and in some cases one hundred) representing the following species and genera have been studied: *Ephedrus incompletus; E. californicus; Praon coloradensis; P. simulans; P. occidentalis; Aphidius nigripes; A. polygonaphis; A. pinaphidis; A. ribis; A. phorodontis;* and *Lysiphlebus testaceipes.* In not a single one of these species was there found a similar variation. On the contrary the maxillary palpi of species of *Ephedrus, Praon* and *Aphidius* so far as indicated by the species studied seem to be constantly four-segmented, while in *Lysiphlebus* there are never more than three segments. The relative length of the segments does often vary slightly and in one or two instances specimens were found in which the segmentation appeared to be incomplete but in no instance was there found so remarkable a condition as in *Diaeretus rapæ.*

In discussing this paper Mr. Rohwer remarked on the variation in the number of joints of the palpi of sawflies and stated that within the genus *Diprion* he had found both symmetrical and asymmetrical variation of five to six joints of the maxillary palpi.

Under the heading of short notes the following communications were presented.

——Mr. Rohwer called attention to the paper by A. Cosens entitled "A Contribution to the Morphology and Biology of Insect Galls," which appeared in the Transactions of the Canadian Institute, volume IX, 1912, pp. 297–387, pls. 1–13. This publication deals with galls primarily from the botanical standpoint, but a number of very interesting observations were made which should become available to all entomologists interested in the study of galls.

In Mr. Cosens' work he has discovered a number of new species and in the genus *Pontania* has been able to distinguish striking morphological differences between the galls of closely allied species. Mr. Cosens proves that the gall is produced by an enzyme, and also that the gall can be produced if the stimulus is not applied to the cambium layer. He also proves that certain inquilines in "Cynipid galls also possess the gall-producing power but to a less extent than the real producer;" and the "gall producing stimulus renders the protoplasm of the host more active and awakens in it

dormant characteristics but apparently does not endow it with the power of producing entirely new structures." Mr. Cosens adds that the awakening of dormant characteristics "has been demonstrated in the case of glands, trichomes and aeriferous tissue;" that "the shape of galls is controlled partly at least by the direction of the stimulus and the location of the egg of the producer. In galls such as those of the Lepidopterous types, where the larva burrows into the tissue after leaving the egg, this feature has no effect." It was found that "the relation of the various zones in the Cynipid galls is influenced in some cases by the early differentiation of the cambium layer." Besides these interesting conclusions the paper contains much valuable matter about the ecology of certain species of gall producing insects, and deserves serious consideration from entomologists as well as botanists. It is hoped that Mr. Cosens will continue this valuable work so that it may eventually be possible to separate all the species of galls by their structure alone.

——Dr. Howard exhibited some photographs made by Mr. Hodge which were shown at the Cleveland meeting of the American Association of Economic Entomologists. The pictures were of a device for catching house and stable flies. Mr. Hodge has devoted much of his time and energy to making a trap to catch these annoying insects. Dr. Howard described the manner in which these insects were captured and stated that in one trap Mr. Hodge had caught $37\frac{1}{2}$ quarts within a short period. He also spoke of another trap which was placed near a cow in which were caught 4 quarts, 90 per cent of which were *Stomoxys calcitrans*. Mr. Hodge stated at that meeting that this trap was placed there for only one week and would have doubtless caught more but for the fact that the trap was full.

Dr. Howard then spoke of an additional orifice near the top which Mr. Hodge was placing on his latest traps which will permit a larger catch.

Mr. A. C. Morgan then read the following paper:

AN ENEMY OF THE CIGARETTE BEETLE.

By A. C. Morgan, *Bureau of Entomology.*

In April, 1912, Mr. W. D. Hunter and the writer, while inspecting a cigar factory at Key West, Florida, to determine the extent of loss due to the cigarette beetle, *Lasioderma serricorne* Fabr., had their attention called to another beetle which was said to do damage to tobacco. The latter insect is known locally as the "Bicho grande," because the adult is much larger than that of *Lasioderma serricorne*. During the examination of this factory several bright red and very active larvæ were found in bundles and boxes of old cigars. Later the adults of this larva, a species of the family Cleridæ were found. Experiments very quickly demonstrated that these red larvæ were predaceous upon the larvæ and pupæ of *Lasioderma serricorne*, and later Mr. G. A. Runner found that the adult Clerid was also predaceous upon larvæ, pupæ and adults of the cigarette beetle.

Adults were sent to Mr. E. A. Schwarz who determined the species as *Thaneroclerus girodi* Chevr. and stated that this was the first record for the United States. In Bull. Ent. Soc. France for 1880, p. xxxi, occurs the only reference to this insect in literature. Here Chevrolat described this species and added a note of which the following is a translation: "This insect, peculiar to Cuba, has been found by Girod in cases of injured tobacco (injured presumably by the cigarette beetle) and was given to me by M. Ant. Grouvelle. It is likely to be predaceous upon the larvæ and perfect insects of the genus *Catorama*."

It is interesting to be able to furnish the proof that this Clerid is predaceous upon *Catorama*, of which genus one of the old species is now known under the name of *Lasioderma serricorne*.

Thaneroclerus undoubtedly occurs also at Tampa, Florida, for during October, 1912, Mr. G. A. Runner and the writer took a few specimens of a bright red larva apparently identical specifically with the ones taken at Key West.

In discussing this paper Mr. Schwarz mentioned the fact that another enemy of dry Cuban tobacco had recently been found in the United States. This species is *Catorama tabaci* Guérin which has frequently been reported as an importation from Cuba in various places in Europe. It was found in Cuban tobacco by a dealer in Philadelphia. More recently it was received at the Bureau of Entomology from the Lopez factory in Key West, Florida. In

this instance a large number of specimens in all stages were received. The species is larger than any of the native species of *Catorama*, and it is strange that its presence in the United States has not been located hitherto. On account of its large size it is likely to cause much more damage to cigars than the cigarette beetle.

——W. D. Hunter exhibited a sketch of a very successful device for breeding *Simulium* perfected by Mr. A. W. J. Pomeroy during his connection with the Illinois State Laboratory of Natural History. The device provides the two essential requisites in breeding *Simulium* larvæ, that is food and well ærated water. It consists essentially of two wooden tanks through which water is allowed to pass. The first of these tanks is partly filled with algæ. The water passing through this tank becomes impregnated with the detritus of the algæ. It then passes through a pipe to a second tank in which the actual breeding takes place. This second tank is provided with lantern globes lying on the bottom on their sides but slightly tilted upward in the direction from which the water flows. When the apparatus is in operation the water passes into the second tank forming minute waterfalls when it flows into the lantern globes. The flow can be regulated so that the discharge through the chimneys is as shallow as a quarter of an inch. It is in this stream that the larvæ or eggs are placed. In actual practice it was found that in this situation they were perfectly at home, not showing any tendency to leave the chimneys.

In the original apparatus the tanks were about 5 feet long. This gave sufficient space in the lower tank for about twenty lantern globes which would allow the breeding of as many isolated lots of *Simulium* larvæ in a space considerably smaller than the top of an ordinary table.

——Mr. McAtee presented the following note: While exploring Lake Pomme de Terre, near Hamburg, Louisiana, last September, my old negro guide inquired whether I would like to see how fish-bait was obtained in that locality. As I expressed an interest in the procedure he pulled up a long leaf stem of *Nelumbo lutea*. All of the stem except a foot or two nearest the leaf was thickly studded with larvæ and cocoons of *Donacia*. The part of the stem bearing them was probably buried in the almost liquid bottom of the lake, the upper layers of which are composed of coarse vegetable detritus.

It was noticed that the feeding larvæ had the head and forepart of the body buried in the cavity they had eaten out of the stem, but that the posterior part of the body was standing out free in the water. This would suggest that, at will, they are able easily to pierce the wall of the stem with their modified spiracles and that perhaps the larva has some other means of securing a supply of oxygen. It would be very interesting to know the composition of the gas in the interior of these stems, as in all probability it is not the same as that of atmospheric air. The adult *Donacia* collected at the time these observations were made has been identified as *D. cincticornis*.

The two following papers were read by title and accepted for publication.

OBSERVATIONS ON THE EGG PARASITES OF DATANA INTEGERRIMA WALK.

By H. M. Russell, *Bureau of Entomology.*

The writer collected the data contained in this paper while stationed at Orlando, Florida, during the years 1907 and 1908. The summer of 1907 seemed to have been favorable to *Datana integerrima* Walk., the black walnut caterpillar, as the colonies of larvæ of this insect were extremely abundant on the pecan and destroyed the foliage extensively. This abundance apparently resulted in a great increase of the egg parasites of this insect as the eggs of the last generation in the fall of 1907 were largely parasitized by minute Hymenoptera. This probably accounts for the smallness of first brood in 1908. At the time of the fall abundance the writer collected a number of egg-masses of *Datana integerrima* and from these reared four species of parasites. The writer is indebted to Mr. J. C. Crawford, of the National Museum, for the determination of three species and to Mr. A. A. Girault for the determination of *Trichogramma minutum* Riley. Of these, *Trichogramma minutum* Riley belongs to the Trichogrammidæ and *Baryscapus* sp. belongs to the family Eulophidæ, subfamily Tetrastichinæ, *Telenomus sphingis* Ashm. belongs to the family Scelionidæ and the fourth, *Ooencyrtus* sp. belongs to the family Encyrtidæ, tribe *Mirini*.

The eggs of the host were collected from August 23 until about the 10th of October, from the various pecan grooves around the station, and each mass was placed in a glass vial. Daily observations were made and the parasites removed and recorded in the notes. These records have been placed in tables, as rendering the data more quickly and easily available to the reader.

In table I the total number of eggs parasitized by the 4 species of parasites is given.

Thus, out of a total of 10,926 eggs of *Datana integerrima* contain tained in 22 egg-masses only 3924 larvæ emerged, or 36.+ per cent, while parasites emerged from 6365 eggs, or 58.+ per cent, and 637 eggs, or 5.+ per cent, failed to disclose either larvæ or parasites. Among these many contained dead parasites, as revealed by dissection.

TABLE I.—*Record of parasitism of eggs of Datana integerrima, September and October, 1907.*

Date.	Number of eggs.	Larvæ hatched.	Parasites hatched.	Eggs unhatched.
September 19	225	0	213	12
October 8	332	0	325	7
	365	0	354	11
	845	839	0	6
	258	256	0	2
	901	0	834	67
	807	0	771	36
	272	260	0	12
	1051	1012	0	39
October 9	204	0	188	16
	67	0	63	4
	138	0	136	2
October 31	1035	0	1021	14
	1054	0	1013	41
	26	0	21	5
	228	195	1	32
November 1	168	90	6	72
	149	126	20	3
	949	0	901	48
	376	178	132	66
	736	432	233	71
	740	536	133	71
Total	10926	3924	6365	637

In table II is given the record of emergence of each species of parasite from 16 egg-masses of the host. In this table each species is designated by letter, A is *Telenomus sphingis* Ashm.; B *Trichogramma minatum* Riley; C *Ooencyrtus* sp., and D an undescribed species of the genus *Baryscapus*. The number preceding the letter indicates the number of individuals which appeared.

In table II it will be observed that many of the egg-masses were parasitized by two or three of these species and in one case speci-

mens of all 4 species were reared from the same egg-mass. The writer has placed a summary of the number of each species reared from 19 egg-masses in table III.

The totals for this table, omitting the partial records in Nos. 7, 9, 13, and 16, show that out of 7187 eggs, 2438, or 33.9 per cent, hatched as larvæ; 2073, or 28.8+ per cent, remained unhatched; and 2676, or 37.2 per cent, gave out parasites. Of these parasites *Telenomus sphingis* emerged to the number of 1515, or 65.6+ per cent; *Trichogramma minutum* emerged to the number of 49, or 2.1+ per cent; *Ooencyrtus* sp. emerged to the number of 686, or 29.7+ per cent; and *Baryscapus* sp. emerged to the number of 59, or 2.1+ per cent. The percentage of parasitism should run considerably higher than this, as many of the unhatched eggs were found to contain dead parasites.

It was observed in the experiments with these egg-parasites that *Trichogramma minutum* would emerge from the eggs at the same time that the larvæ of the host were hatching, indicating a short period of development for this species.

Telenomus sphingis and *Ooencyrtus* sp. were observed to emerge from the host eggs about five days after the larvæ had emerged, and frequently both species would emerge from an egg-mass at the same time.

The fourth species, *Baryscapus* sp., was observed to emerge from three to eleven days after *T. sphingis* and *Ooencyrtus* sp. had emerged.

Many of the egg-masses collected were almost totally parasitized, as from nearly every egg a parasite emerged. In others it was observed that although the eggs were extensively parasitized, many of the parasites either died in the eggs without cutting a hole or after cutting an emergence hole could not free themselves and died while partially out of the host egg. In one case observed, from a mass of 968 eggs only 176 parasites emerged, while 694, after partially eating their way out, died in the shells. This was probably owing to a lack of moisture, due to the artificial method of rearing in vials.

Telenomus sphingis was by far the most abundant and important egg-parasite of *Datana integerrima* of the four species under observation. This is a minute, black-bodied insect with yellowish legs and hyaline wings. The process of oviposition of this species was observed and will illustrate in a general way the process for the others.

The female crawls rapidly over the eggs with the antennæ in constant motion, examining them until she finds one that seems suitable. She then halts and explores the surface of this egg with her antennæ, at the same time turning around repeatedly until the entire surface of the egg beneath her has been examined. If satisfied, she takes a

TABLE II.—*Record of emergence of egg-parasites of Datana integerrima.*

Number of eggs in mass	Dates parasites emerged with number and species, October–November, 1907.															
	Oct. 2	Oct. 3	Oct. 4	Oct. 5	Oct. 7	Oct. 8	Oct. 9	Oct. 10	Oct. 11	Oct. 12	Oct. 14	Oct. 15	Oct. 16	Oct. 30	Oct. 31	Nov. 1
167								66-A	1-A						20-C	
889	5-B	9-B	12-B	8-B	11-B	65-A	61-A	72-A	4-A	7-C	8-C					
690	3-A	9-C	12-A 11-C		15-A					1-C						
848			25-A		37-A	1-A 2-C	2-A 2-C						1-C			
387					18-A		1-A	35-A	15-A	6-A 4-C						
968		127-A 2-D	58-A 4-D	20-A	194-A	8-A									185-A	
1024					45-B											
809				13-C	29-A 23-C	87-A 14-C	58-A 33-C	1-A 23-C	3-C		25-C 3-D	3-D	9-D		221-A 4-B	
186						56-A	37-C									
672						3-C	4-C	4 C	2-A 1-C 1-D							
144															26-A	
244								10-A	26-A	1-A						
868														11-A 465-C 13-D		5-A 3-C 25-D
28															3-A 6-B 7-C	
27															13-A	3-D

position on the side of the egg, and partly upon the egg next to it, and suddenly dropping the tip of the abdomen, forces the ovipositor into it. During the egg-laying process she keeps up a slight pulsating movement of the body and vibrating motion of her antennæ, while some of her legs also are in motion. After a short time she withdraws the ovipositor and with it apparently scratches the surface of the shell. She then moves away and cleans herself; first the antennæ, by rapidly brushing the forelegs over them, then the fore legs and middle legs, by passing them through her mouth. She cleans her wings and abdomen with the hind legs. After this process is completed the female begins to examine the eggs again for a suitable one in which to oviposit and in doing this she may select the first or reject several. The time consumed in the deposition of an egg was observed to vary from $2\frac{1}{2}$ minutes to $8\frac{2}{5}$ minutes and for six eggs averaged $5\frac{2}{3}$ minutes, while the interval between oviposition was observed to vary from 15 seconds to 12 minutes. As this insect develops in the host egg the latter changes from a pearly white to a dull black. This same result is produced by each of the other three parasitic species, and a few days after the eggs are parasitized these may be easily separated from the healthy eggs. When the parasite is mature, it chips away the eggshell of its host, making a hole nearly one-half the diameter of the egg, and through this it emerges.

Trichogramma minutum is a very tiny, yellow creature with red eyes and is not half so large as *Telenomus sphingis*. The parasitism by this insect was not very extensive in the number of eggs destroyed, possibly owing to the fact that generally several eggs are laid in each egg of the host, and also to the fact that this parasite has so many other hosts.[1] The writer has reared it from the eggs of *Calpodes ethlius* Cram. in Florida, and in southern California from the eggs of *Peridroma magaritosa* Haw., *Phlyctænia ferrugalis* Huebn., *Dione vanillæ* L., and *Tortrix* sp. This insect develops rapidly and when ready to emerge from eggs of *Datana integerrima* one of the inclosed parasites cuts a small circular hole not over one-fourth the diameter of the egg. This may be on the top or down on the sides, and in a few cases two holes may be found in one egg. As soon as the hole is large enough the insect works its head through, the forelegs follow, and in a short time it pulls itself free. Immediately another of the parasites appears at the hole and works its way out and so on until all have emerged. In one of the two cases in which the entire process was observed, 4 parasites emerged from the single egg, and in the other 5 emerged.

Next to *Telenomus sphingis* the most important of the egg-para-

[1] Girault records 45 species belonging to 4 orders as hosts of this insect. Bul. Wisc. Soc. Nat. Hist., vol. IX, No. 4, p. 161, October, 1911.

sites of *Datana integerrima* is a species of *Ooencyrtus*, which in these experiments was about half as numerous as *T. sphingis*. In many cases it was found infesting eggs in the same mass as *Telenomus sphingis*, but in some it occurred alone. This insect is about the size of T. *sphingis* and to the unaided eye has the same general appearance, but it may be easily distinguished by its white-and-black legs. This species aids materially in reducing the numbers of its host, as shown by the fact that out of about 8000 host eggs, 720 parasites of this species were reared. According to the views of the writer what is doubtless the same insect has also been reared by him from the eggs of *Schizura concinna* S. & A., at Orlando, Fla.

Baryscapus sp. is probably a hyperparasite of *Telenomus sphingis* and *Ooencyrtus* sp., as it occurs in the same egg-masses with them to a limited extent and is always days behind the others in emerging. It is longer than the other species and one sex is black, while the other is dark brown, while both sexes have red eyes. Only 50 specimens of this insect were reared from nearly 8,000 eggs of *Datana integerrima*, showing that it is not very abundant as compared with the other parasites reared.

TABLE III.—*Summary of egg-parasitism of Datana integerrima, September to November, 1907.*

Expt. number.	Number of eggs.	Number of larvæ.	Number of unhatched eggs.	*Telenomus sphingis.*	*Trichogramma minutum.*	*Ooencyrtus* sp.	*Baryscapus* sp.
1	168	2	78	67	0	20	0
2	889	300	301	202	45	19	0
3	690	593	31	30	0	21	0
4	848	393	320	65	0	5	0
5	387	156	147	75	0	4	0
6	968	9	265	592	0	0	6
7	1024	697	55	?	45	others escaped.	
8	809	41	231	390	4	134	12
9	186	?	?	56	0	37	0
10	672	522	132	2	0	15	1
11	144	0	64	26	0	0	1
12	244	0	199	37	0	0	0
13	1191	?	?	?	?	?	?
14	473	0	40				
15	868	422	255	16	0	468	36
16	28	?	?	3	6	7	0
17	27	0	10	13	0	0	3
Total	9615	3116	2258	1574	100	720	59

TABLE IV.—*Egg-parasitism of Datana integerrima for the spring brood of 1908.*

Mass Number.	Number of eggs in mass.	Number of larvæ hatched.	Number of parasites hatched.	Number of eggs not hatching.
1	393	304	4	85
2	683	402	109	172
3	789	0	752	37
4	779	502	186	101
Total..	2644	1208	1051	395

In the spring of 1908 the pecan trees were very closely examined for eggs of the host of these 4 species of parasites, but very few egg-masses or larval colonies of the first brood could be found, even in the groves where the summer before they had been abundant. Only 4 egg-masses were collected and they furnished the data on the egg parasitism of the spring brood as shown in table IV.

Calculating the percentages from this table, 45 per cent of the eggs hatched, as larvæ, 39.+ per cent were parasitized, and 14 per cent failed to hatch. As these were the eggs of the first brood in the spring, the number of parasites emerging indicated that the parasites passed the winter in some numbers. When considered in connection with the percentage of parasitism of 58.+ per cent for the eggs of the fall brood of *Datana integerrima* in 1907, it appeared that the parasites had a fine chance to hold this insect in check during 1908. Unfortunately the writer was compelled to leave the State at that time and the observations could not be completed.

Aside from these observations, Gossard[1] wrote, under natural enemies of *Datana integerrima*, that "the eggs are attacked by a hymenopterous parasite."

H. A. Morgan[2] recorded *Telenomus gossypiicola* Ashm. as "an active egg-parasite in Louisana," but the writer is inclined to believe that he had *Telenomus sphingis*, as these two species run very close together in Ashmeads tables.[3]

Later Herrick,[4] writing of *Datana integerrima* said, "There is also a small insect that is parasitic on the eggs of the moth. Professor Morgan says that out of one batch of twelve hundred eggs every one was parasitized."

[1] H. A. Gossard. Bul. 79, Fla. Agr. Exp. Sta., p. 301, 1905.
[2] H. A. Morgan. Bul. 69, 2d ser., La. Agr. Exp. Sta., p. 882, 1902.
[3] W. H. Ashmead. Bul. 45, U. S. Nat. Mus., p. 144, 1893.
[4] G. W. Herrick. Bul. 86, Miss. Agr. Exp. Sta., p. 21, 1904.

A NEW GENUS OF STREBLIDÆ.

By Charles H. T. Townsend.

The following form is of exceptional interest as representing a new genus of ancient affinities in the very interesting Pupiparous family *Streblidæ*, as coming from the little-known region of northwestern Peru, and as inhabiting a host hitherto known only from the description and figures published in 1877 with record of occurrence at Tumbez, Peru, on the Gulf of Guayaquil, but rediscovered by the writer at Piura.

SNYTHESIOSTREBLA gen. nov.

Approaches *Trichobius* in wing character and *Megistopoda* in hind legs. Thorax conspicuously broader than long, gently widened posteriorly. Scutellum short, subcrescentic, bulged posteriorly, gently concave on anterior border. Abdomen narrowed, segments not distinct. Extra hind crossvein between fifth and sixth vein opposite to end of first vein, only a little distad of small crossvein, latter close to origin of third vein whose base is bent abruptly costad from it, no emargination of distal wing-border; the wings elongated, about two and one-half times as long as broad, fully developed and functional, with the characteristic six longitudinal and three crossveins, the first vein ending but slightly beyond middle of wing, thus contrasted with both *Strebla* and *Trichobius*. Front legs very short, middle legs a little longer, the femora, tibiae and tarsi in these about equal as to length in same pair of legs; hind legs nearly three times as long as front ones, the hind metatarsi much elongated, the hind coxae enlarged and elongated; last tarsal joint of all feet moderately elongated and widened, the claws not toothed. Eyes present. Antennae normal. Habitat on the very rare and little-known bat, *Amorphochilus schnablii* Peters, ranging from Piura to Tumbez, in the northern coast region of Peru.

Type, *Synthesiostrebla amorphochili* n. sp.

Synthesiostrebla amorphochili new species.

Length of body, fully 1 mm.; hind legs, scant 1.5 mm; front legs, 0.4 mm.; middle legs, 0.5 mm.; wings, 1.2. mm. One specimen, probably female, from bat collected at Piura, Peru, February 1, 1911 (Townsend).

Entire insect pale brownish-yellow, abdomen more deeply colored, claws black. Front edge of mesoscutum with a pair of strong teeth on median line directed anteriorly and fitting into corresponding grooves in back of head. A pair of strong bristles, longer than any others on body, situated near hind margin of mesoscutum on median line in front of scutellum. Body and legs with many stiff short sharply-pointed bristles, a few also on costa. Wings clear, veins yellowish. Shorter bristles over legs, wing costa, and on distal borders of the leaf-like palpi.

The host was determined by Mr. E. W. Nelson, of the Biological Survey, Washington.

Regarding the venation of the *Streblidæ*, it must be noted that the veins appear to have evoluted outwardly or distally, especially the inner basal veins, greatly elongating the second and third basal cells from the Holometopan type by drawing their crossveins nearer to the wing-tip. Hence what is called in the above description the extra hind crossvein is probably the crossvein of the anal or third basal cell, and the first or outer hind crossvein (between the fourth and fifth veins) is probably the cross vein of the second basal cell, while the true (Holometopan) hind cross vein has been lost. At all events these second and third basal-cell crossveins are no longer apparent in their ordinary position (judged by the Holometopan type) in the *Streblidæ*, and the general outward trend of all the veins exhibited by this family supports the above conclusion. The effect has perhaps been accelerated by a concurrent shortening of the wings, as suggested in Aspidoptera.

Synthesiostrebla stands farther removed from *Strebla* on both venational and mesoscutal characters than does *Trichobius*. It represents a relatively less outward evolution of the veins than that shown in any hitherto known Streblid genera, and thus appears to be a persisting fragment of an older and probably an ancient Pupiparous stock. The fourth, fifth and sixth veins do not reach the wing border, stopping farther from latter than in *Trichobius*, while even the third vein stops slightly short of apical border. The form is in all probability a relic by direct descent from an old stock stranded in western America since the Mesozoic—a stock that accompanied the northward dispersals between Antarctic and South America during or prior to the Cretaceous.

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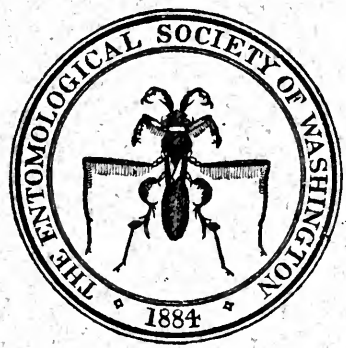

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PROCEEDINGS

OF THE

ENTOMOLOGICAL SOCIETY

OF WASHINGTON

VOL. XV 1913 No. 3

Meeting of February 6, 1913.

The 265th regular meeting of the Society was entertained by Mr. August Busck at the Sængerbund Hall, 214 C st. N.W., on the evening of February 6, 1913, and there were present Messrs. Baker, Barber, Busck, Caudell, Cory, Craighead, Cushman, Duckett, Fisher, Gahan, Gill (T.N.), Heidemann, Heinrich, Hood, Hopkins, Knab, McAtee, McIndoo, Malloch, Middleton, Popenoe, Rohwer, Sanford, Sasscer, Schwarz, Shannon, Snyder, Timberlake, Walton, and Wood, members, and Messrs. R. F. Bower, de la Torre Bueno, W. T. M. Forbes, J. R. Horton, V. King, W. O'Connor, C. E. Pemberton, H. J. Quayle, W. F. Turner, and W. H. White, visitors. President Busck occupied the chair. The minutes of the preceding meeting were read and approved.

Mr. Rohwer mentioned the resignation of Messrs. S. E. Crumb and Mr. H. L. Viereck as members from the Society.

Mr. Cushman proposed the name of W. F. Turner for active membership.

Mr. Rohwer read a letter from Mr. J. C. Crawford resigning as editor of the Proceedings. Mr. Schwarz moved that the resignation be accepted; seconded by Mr. Knab; carried. Mr. Rohwer then said that the Executive Committee recommended the election of Mr. W. D. Hunter as editor. On the motion of Mr. Schwarz, seconded by Mr. Knab, Mr. Hunter was duly nominated and elected.

The first paper of the evening by Mr. Nathan Banks on "New Costa Rican Arachnids," which was read by title and the second, by Dr. A. D. Hopkins "On the Classification of Scolytid Beetles," will be published later.

The third and last paper was by Mr. August Busck which follows.

TWO MICROLEPIDOPTERA INJURIOUS TO CHESTNUT.

By August Busck.

Bureau of Entomology.

Sesia castaneæ, new species.

Labial palpi yellow on the underside; above black, sprinkled with yellow scales; apical half of third joint all black. Antennae black with the tips bronzy fuscous. Face bluish black with the face before the eyes broadly white. Head black. Thorax metallic bluish black with two narrow lateral stripes yellow; in the female also with posterior edge narrowly yellow. Forewings alike in the two sexes, transparent, with bluish black scaling on the veins, slightly mixed with golden yellow scales; cilia purplish black. Hindwings transparent with narrow black veins and with yellow costal edge, which shows through the membrane of the forewing when in natural position; cilia purplish black. Abdomen deep bluish black with posterior half of fourth joint yellow on the underside; in the female the extreme edges of third and fourth joints are also narrowly yellow on the dorsal side; the base of the abdomen laterally yellow; the inner side of the male claspers dark ochreous. Legs bluish black with narrow yellow annulations at the end of the joints; the tarsi of the females dusted with yellow.

Habitat: Lynchburg, Virginia, and Snow Shoe, Pennsylvania, F. C. Craighead, coll.

Foodplant: Chestnut.

Type: U. S. Nat. Mus. No. 15505.

Bred from the trunks of chestnut by Mr. F. C. Craighead. The fullgrown larva is about half an inch long, yellowish white with light brown head and with yellowish thoracic shield and thoracic legs; setae short and pale; hooks on abdominal feet in two rows with from ten to twelve hooks in the posterior and from twelve to sixteen in the anterior row.

The adults emerged April 12, and May 21, 1912.

The species is nearest in size and coloration to *S. pictipes*, Grote and Robinson, and has been mistaken for this species, which according to the earliest records is injurious to plum, cherry and peach; Grote himself identified (Bull. U. S. Geol. Surv., VI, p. 287, 1881) the species bred by Bailey and Kellicott, from plum and cherry (Can. Ent., XIII, p. 7, 1881) as his *S. pictipes*.

Beutenmuller records it also from chestnut, but this record was undoubtedly caused by a misidentification of the present species. The chestnut species may be distinguished from *S. pictipes* by the

larger white, not yellow, cheeks, by the black, not yellow, collar and by the absence of yellow on the second joint of the abdomen.

Ectoedemia castaneæ, new species.

Palpi and lower face ochreous. Upper face and head black. Antennae blackish brown with narrow yellow annulations and with large milk-white eyecaps contrasting strongly with the dark tufted head. Thorax blackish brown sprinkled with ochreous scales, especially posteriorly; posterior tip ochreous. Forewings blackish brown liberally sprinkled with bluish white scales. Cilia fuscous. Hindwing dark fuscous, blackish along the costa with lighter ochreous fuscous cilia; in the males with a strong yellowish costal hair tuft. Abdomen dark fuscous with ochreous anal tuft and ochreous underside. Legs light silvery ochreous. Alar expanse: 7.5–8 mm.

Habitat: Vietch, Virginia.

Type: U. S. Nat. Mus. No. 16333.

The life history of this species has recently been ascertained by Dr. A. D. Hopkins and Mr. T. E. Snyder, who have bred it from small galls on young twigs of chestnut, reminding one in form and size of the egg masses of the forest tent-caterpillar.

The larva resembles that of *Nepticula;* the head is small, normal, retractive into the first thoracic segment which lacks all trace of feet; the other thoracic feet and all the abdominal feet are represented by rudimentary processes; such are found on joints 3 and 4, 6, 7, 8, 9, 10, and on joint 13 while they are faintly indicated on joint 5; thus joints 11 and 12 are the only ones beside 2 which have no trace of feet. In *Nepticula* the formula is ". . 2 . 6 . . ".

The species is close to *E. obrutella* Zeller, which species must be included in the present genus, but differs in the darker thorax and forewings. *Obrutella* was described in the genus *Trifurcula*[1] but shows some important difference in pterogostic characters from the type of this genus, *T. pallidella,* of Europe (fig. 1b).

The life history of *Trifurcula* is not known.

The leaf mining genus *Nepticula*[2] (fig. 1c), typically shows a reduction of the venation by the absence of vein 8 and of the cubital veins; in some of the larger blotch-making species of the genus however, these veins are present or at least indicated and the venation is practically that of the gall-making *Ectoedemia.*

[1] Verh. Zoo-bot. Gesell. Wien, XXIII, p. 316, 1873.

[2] I use the geonym *Nepticula* advisedly, instead of *Stigmella* Schrank, as adopted by Lord Walsingham and Mr. Durrant. The earlier name, *Stigmella,* is a *nomen nudum,* whether by accident, as held by Lord Walsingham or not, and is for that reason in my opinion not available as a substitute for *Nepticula* Zeller.

These three genera, *Ectoedemia* (fig. a), *Trifurcula* (fig. 1b), *Nepticula* (fig. 1c), together with *Scoliaula* Meyr. (fig. 1d), form a well separated group among the *Tineæ aculeatæ*. All the species are among the smallest of the Lepidoptera, averaging from 4 to 9 mm. in alar expanse. All have a many spined frenulum in both sexes.

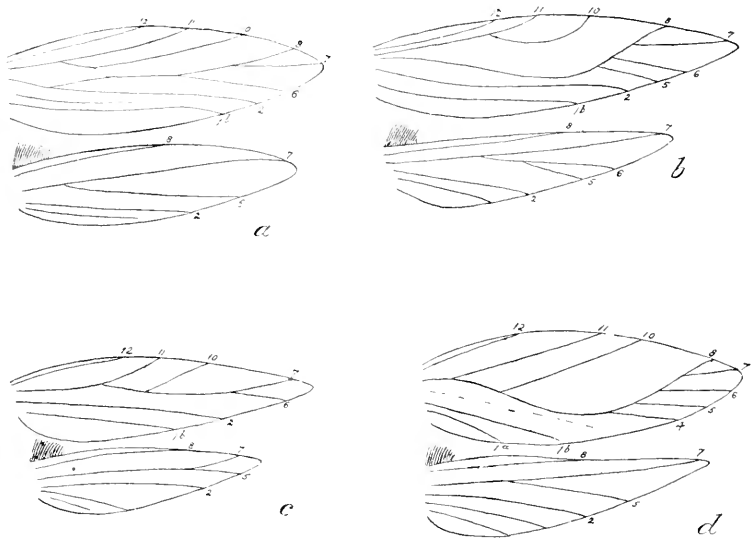


Fig. 1. a, *Ectoedemia populella* Busck; b, *Trifurcula pallidella* Zeller; c, *Nepticula microtheriella* Stainton; d, *Scoliaula quadrimaculella* Boh.

Under notes and exhibition of specimens Mr. Schwarz read by title the following note by Mr. Chas. R. Ely, of Frederick, Md.:

THE FOOD PLANT OF CLEONUS CALANDROIDES RAND.

By Chas. R. Ely, *Frederick, Md.*

About the 10th of August, 1912, my daughter while playing on the sea beach, near East River, found the larvæ of a weevil living in the roots of *Cakile endetula* Bigel. Because of her interest in the insect we collected, on August 14, a large number of the various stages, from larva to adult. Specimens which later emerged from the pupæ were identified by Mr. E. A. Schwarz as *Cleonus calandroides* Rand.

So far as we observed the larvæ live wholly in the roots, and that portion of the root lying within 2 or 3 inches of the surface of the ground is most subject to attack. Transformation takes place within a cocoon, constructed, chiefly of small shreds of plant fiber, which is built up in a longitudinal excavation, made by the larva in one side of the root. About one-third of this cocoon lies outside of the root itself and is in sharp contrast to it because of its much darker color.

As stated above, all stages, from half grown larvæ to the adult beetles were to be found on August 14, and quite a number of the empty cocoons were also to be seen.

The beetles were evidently present in very great numbers, as practically every root of a Cakile plant that was examined, over a strip of beach a quarter of a mile long, was found to be more or less attacked by them.

Mr. J. R. de la Torre Bueno exhibited and remarked upon the following insects:

Neuroctenus simplex Uhl., an Aradid, two specimens of which had mites fastened to the underside of the body, in one case one specimen on the connexivum, and in the other case two on the mesosternum, between the legs. The eggs of this species were also shown, fastened in clusters to the inner side of bark. Two clutches were parasitized by a minute Proctotrypid, which showed dark through the corium of the infested ova, and a mounted specimen of this was shown, which flew out from the home of the bug as the bark was lifted. *N. simplex* is commonly found under the bark of dead oak saplings. The female would seem to brood her eggs, to judge by the actions of two found over the two batches, from one of which the red young were emerging. The actions of the females gave color to the interpretation of maternal solicitude put upon her position with the abdomen extended over the egg masses. This is a very rare phenomenon in the Heteroptera, the best attested example being the classic instance of the European Cimicid, *Rhaphigaster nebulosa* Poda (*griseus* Fabr.)

A specimen of *Sinea spinipes* H. S. taken at Yaphank, Long Island, New York, in the pine region of the island. This is the most northern record of this species, described originally from South America and later recorded from western United States, and heretofore naturally considered strictly southern.

Eggs and nymph of *Melanolestes abdominalis* were also shown. This large Reduviid lives under stones and lays its eggs in the earth. The crown of filament that surmounts each egg is flush with the surface. The ova shown were secured from specimens in captivity.

An egg-mass of *Microvelia americana* Uhl., which had been deposited on the sides of an aquarium, just above the water-level was brought to the attention of the meeting. From aquarium observations it has been concluded that this tiny semi-aquatic bug deposits its eggs on stones or sticks at the water's edge, but not under water. The eggs are laid in a clear jelly-like glue, which secures them to the objects on which they are deposited.

Meeting of March 5, 1913.

The 266th regular meeting of the Society was entertained by Mr. C. L. Marlatt at his home 1521 16th street N.W., on the evening of March 5, 1913, and there were present Messrs. Baker, Burke, Busck, Cory, Craighhead, Cushman, Duckett, Fisher, Gahan, Green, Hall, Hood, Hopkins, Howard, Hunter, Hyslop, Knab, McIndoo, Marlatt, Popenoe, Quaintaince, Rohwer, Sanford, Sasscer, Shannon, Siegler, Snyder, Webb, Webster, and Wood, members, and Messrs. H. Bradford, W. E. Edmonston, D. G. Fairchild, J. R. Horton, J. M. Miller, A. Rosenfeld, H. B. Scammel, and J. F. Strauss, visitors. President Busck occupied the chair. The minutes of the preceding meeting were read and approved.

Mr. W. F. Turner was elected an active member of the Society.

Dr. Hopkins proposed the names of J. M. Miller, Joseff Bruner, and W. D. Edmonston for corresponding members. In accordance with the by-laws these names were referred to the Executive Committee for action.

The first paper of the evening was "Monsters of our Backyard," by David Fairchild. This very interesting paper, which has been published in the National Geographic Magazine, was illustrated with lantern slides made from greatly enlarged photographs of certain common insects in characteristic attitudes. At the conclusion of Mr. Fairchild's talk, Mr. Marlatt moved that the Society

extend Mr. Fairchild a vote of thanks for exhibiting these pictures for the first time to its members.

The following paper was read by title: "Pseudomasaris Bred in California" by T. D. A. Cockerell.

PSEUDOMASARIS BRED IN CALIFORNIA.

By T. D. A. Cockerell.

A number of years ago at Pecos, New Mexico, my wife and I found *Pseudomasaris vespoides* (Cresson) in quantity, visiting flowers of *Pentstemon*. Numerous efforts to follow the wasps to their nesting places were wholly unsuccessful, much to our disappointment. I was therefore greatly interested to receive, a few days ago, a *Pseudomasaris* from Professor D. E. Merrill, with the information that it had been bred by Dr. George Robertson at Redlands, California, from a nest having the shape of an inverted cone, and composed principally of sand, fastened to the stem of some plant. In being fastened to the stem of a plant, the nest resembles that of *Celonites*, but apparently differs in the openings being directed upwards instead of downwards, as well as in the shape. The insect is very close to the Rocky Mountain *P. vespoides*, but apparently subspecifically distinct.

Pseudomasaris vespoides robertsoni, new subspecies.

Female: Like *P. vespoides*, but with the sculpture of the mesothorax not so coarse; scutellum with the small punctures closer and finer, the large ones few and very weak; median black lobes of abdominal bands rather more extensive; last ventral segment of abdomen with a median black stripe, broadening basally, on its basal half.

Habitat: Redlands, California, June, 1912 (G. Robertson).
Type: Cat. No. 15529 U. S. N. M.

Meeting of April 3, 1913.

The 267th regular meeting of the Society was entertained by Mr. E. A. Schwarz in the Sængerbund Hall, 314 C street N.W., on the evening of April 3, 1913, and there were present Messrs. Baker, Banks, Barber, Burke, Busck, Caudell, Cory, Craighead, Cushman, Dyar, Fisher, Gahan, Hall, Heidemann, Heinrich, Hood, Hopkins, Howard, Hunter, Jennings, Knab, Meyers, Pierce, Rohwer, Sasscer, Schwarz, Shannon, Snyder, Turner, Walton, and

Wood, members and Messrs. Vernon Bailey, Adam Böving, H. G. Dyar, W. T. M. Forbes, and H. B. Kirk, visitors. President Busck occupied the chair.

Mr. Rohwer reported that the vote taken in accordance with the constitution for the election of Honorary Members resulted in the unanimous election of Dr. David Sharp of England, and Dr. J. H. Fabre of France. Mr. Rohwer also reported that the Executive Committee had acted favorably on the names of J. M. Miller, Joseff Bruner, and W. D. Edmonson for corresponding membership and on a vote of the Society they were duly elected.

The first paper of the evening "The Insect Host of Forest Malaria" by Dr. Adolph Lutz was read by Dr. L. O. Howard.

THE INSECT HOST OF FOREST MALARIA.

By Dr. Adolph Lutz, *Rio de Janeiro.*

I see by the Proceedings of the Entomological Society of Washington that Mr. F. Knab read a paper, "The Dependence of Disease Transmission by Blood-Sucking Insects Upon Habits." When Dr. L. O. Howard cited a paper of mine Mr. Knab declared that he had just discussed this paper from his present view point with Dr. Dyar and they had come to the conclusion that I had misinterpreted the facts. A similar statement is repeated in a paper in the Journal of Economic Entomology. To explain this singular conclusion Mr. Knab thinks it highly probable "that the men observed by Lutz already harbored malaria in a latent form when they came into the region and that the exertion and exposure incident to the work caused the irruption of the disease."

If such an etiology of a typical epidemic was possible, which no competent person would admit, the people living here and interested in the case would not have waited for two laymen to think of it and I would not have troubled to find a satisfactory explanation for a puzzling fact. Mr. Knab however continues:

"It is a well known fact that in the tropics most persons apparently in good health have latent malaria." Leaving alone the fact that the place of observation and the places where the patients came from have not a tropical climate, the statement itself is utterly erroneous and about equal to the statement that in hot countries everybody is suffering from liver disease. After excluding typhoid fever and other pyrexias with different etiology, it has become evident that malaria is very much localized and by no means generally prevalent, even in tropical countries. In fact it

is wanting in many places where there are Anophelidæ, which are by no means ubiquitous.

My paper on forest malaria has been everywhere accepted without contradiction, and since I wrote it the facts have been confirmed by several people. Dr. Chagas observed another epidemic under absolutely similar conditions and near the same place and authorized me to state that he is convinced of the correctness of my explanations, which is of interest, as he has observed several epidemics of malaria in different places and studied the Anophelidæ found. I myself have seen another epidemic and there are some more on record showing the occurrence of epidemical malaria in places where there are plenty of epiphytic Bromeliaceæ and no swamps. It is now a generally recognized fact in this country that all the great works of engineering, where hundreds and thousands of workmen have to sleep in the open air, will lead to epidemical outbreaks of malaria, even in quite uninhabited regions where there are swamps due o the perodical inundations of the rivers. The observations in the uninhabited mountain woods of the coast range are quite analogous and just as certain, with the difference that the higher places get infected later and never in the cold season. On the other hand the very same workmen have done the same work in the dry Campos regions and in the woods of the interior where there are no Bromelia Anophelidæ without the slightest malarial manifestations.

Of course a few chronic malaria patients must be present and these will be found amongst the workmen who previously took part in similar work, but these people, far from being quite healthy, could be picked out and excluded, as I proposed long ago.

In this country *Cellia argyrotarsis* is much more responsible for the spreading of malaria than *albimana*. Both the species are frequent in uninhabited places and only come near the houses when these are built in swampy regions, excepting very few stragglers. That they do not want or prefer human blood is shown by the quite well known fact here that they prefer the horse to the rider and large numbers of them might be caught on horses by persons who do not get bitten themselves. The same is true for all other species of Anophelidae.

Now it is quite natural that the workmen in uninhabited places where big game is rare will attract the mosquitoes and if they stay long enough in the same place the epidemic will follow the increase of the infection in the mosquitoes who themeslves augment in number through the facility of alimentation. It is a well established fact that a species might be an excellent intermediate or definite host of a parasite quite new to the country because the host for the other stage has only been introduced recently.

The second paper of the evening, by Mr. Knab, in reply to Dr. Lutz, was read by Dr. Dyar.

THE CONTENTIONS REGARDING "FOREST MALARIA."

By Frederick Knab, *Bureau of Entomology.*

Dr. Lutz's protest against my remarks on malaria transmission by *Anopheles boliviensis* Th.(=*A. lutzii* Th.) is interesting and stimulating. It seems almost superfluous to say that I have the greatest admiration for the work of Dr. Lutz as I am sure have all who have become acquainted with it. Personally I have derived much inspiration from the writings of Dr. Lutz and to discredit him was far from my intention. The criticism to which he objects resulted naturally through the defense of an idea which I still believe is correct in principle. The question is a zoölogical one rather than a medical one, the pathogenic character of the parasite being merely an incident and the fact that Dr. Lutz is a skilled naturalist as well as a physician leads me to hope for points of contact. I must reiterate, for the benefit of careless readers, that my remarks were, from the beginning, intended to cover only blood-parasites having life-cycles in alternate hosts and involving a blood-sucking insect. It may be here appropriately pointed out that a train of thought very similar to my own led Grassi to his great discovery, which was not, as generally formulated, that *Anopheles* transmits malaria, but that definite species of *Anopheles* do so. He conceived the idea that the transmitting blood-sucking insect and the disease must show the same distribution, and this corresponds very closely to what I have formulated. There is, therefore, really nothing new or startling in my contentions. What I do claim, however is that this aspect should not be neglected by investigators.

I have again carefully read Dr. Lutz's famous paper and also his present communication. From these it would appear that in the question under dispute, which involves the principle formulated by me, we agree on every point but one, namely the question of the insect host in the malaria epidemic under discussion. I am glad to admit that offering an explanation of conditions at such a distance, and concerning which I had no accurate information, was rash; but it was only a suggestion and is now withdrawn in the face of the facts brought forward by Dr. Lutz. We find ourselves on common ground in believing that the malarial outbreak observed among a large gang of workmen encamped in a previously uninhabited forest was not endemic there, but was brought into the locality by such of the workmen as already harbored the malarial parasites, and that it was transmitted from man to man by a spe-

cies of *Anopheles*. I am, however, unwilling to believe that a species of *Anopheles* which is peculiar to uninhabited forests and under normal conditions can not obtain human blood should forthwith become the host of a blood-parasite of man. It is true that such a case might occur and that we may have it before us in the one under discussion, but in my opinion this would be so exceptional that it would have to be very fully proven.

There is every indication that the host-relation between the malarial parasites and certain species of *Anopheles* is conditioned by a very fine physiological adjustment. Thus it has been commonly observed that of a number of species occurring in a given locality and all obtaining their blood-meals from the same source, some serve as efficient hosts for the parasites while other species simply digest the parasites with the blood. Very often the commonest *Anopheles* of a region will not be the one to serve as host. This is the case, for example, with our *Anopheles punctipennis*, and it is well established that *A. rossi* holds a similar relation in the Orient. James and Liston may be quoted to good advantage in this connection:

We have already mentioned that some species of "anopheles" are better malaria-carriers than others, and apart altogether from the fact that "anopheles" may be abundant in a place without there being any malaria at all, it often happens that the species which is present most abundantly is not the one which is carrying malaria at the time. It is, however, a difficult matter to estimate the relative abundance of different species in any place, for some are much more easily seen than others, and the habits which some species have of secreting themselves among the straw of a thatched roof and of resting only upon objects which are as nearly as possible the same colour as they are themselves, are very important. In order to exemplify this, it seems worth while to recount an instance which happened in our experience. In the malarious village of Ennur in the Madras Presidency, *A. rossi* was so abundant that on almost every straw of the thatched roof of every house three or four specimens of this species were resting. A careful search in the ordinary way did not reveal the presence of any other species, and it is certain that, had there been no other object in the search than the mere determination of the species of "anopheles" present in the village, the observer would have gone away quite satisfied that *A. rossi* was alone present. But the village was an extremely malarious one, and knowing that *A. rossi* was an inefficient carrier of malaria in nature, he was unwilling to believe that no other species was present in the houses. Fixing his mind, therefore, upon the thought that he was looking for *A. culicifacies* and not *A. rossi*, he again commenced the search with great care, and was rewarded not only by detecting the presence of *A. culicifacies*, but by catching a sufficient number of this species during several days' work, to prove that it was the species respon-

sible for the prevalence of malaria in the place and not the very much more abundant species *A. rossi*.[1]

Now we find that upon a short visit of investigation Dr. Lutz found a single species of *Anopheles* in the locality and at once concluded that this was responsible for the malarial outbreak. "Ich war sofort überzeugt, die gesuchte Mückenart gefunden zu haben obgleich damals über die Charaktere der Malariaüberträger noch nichts bekannt war. Als bald darauf erkannt wurde, das dieselben unter den *Anopheles*-Arten zu suchen seien, sah ich mit Befriedigung, das die neue Art ein *Anopheles* war."[2] He assumed that no other species of *Anopheles* could be present in the locality because it appeared to him that there were no suitable breeding-places other than the bromeliads. In fact I have found three species of *Anopheles* breeding in small pools in the bed of a mountain stream, where the topographic conditions must correspond very closely with those outlined by Dr. Lutz, and two of these species (*A. argyritarsis* and *A. eiseni*) occur also in southern Brazil. I have repeated these observations on two visits to Córdoba, Mexico (June, 1905 and December, 1907, to April 1908), and found the larvæ on these occasions in a canyon which is virtually scoured out by the mountain torrent after every heavy rain. Similar observations are at hand from the rapid streams in Panama. Furthermore it may be pointed out that during a five months stay at Córdoba I did not capture a single adult *Anopheles*, and had I not collected the larvæ I should have been led to conclude that no *Anopheles* occurred in that locality. It may therefore be pardonable if I express my incredulity that no other than the bromelicolous *Anopheles* were present in the locality described by Dr. Lutz. Aside from this possible or even probable presence of other *Anopheles*, which admittedly might be in such small numbers as to be a negligible factor, there may be still other sources of error. The question naturally arises: How completely and for how long a period were the workmen confined to the forest habitat? Did they not, singly or in small parties, take holidays outside that zone or make nocturnal visits to taverns and pleasure resorts beyond its confines? From what we know of the habits of *Homo* in general we have a right to suspect this! In short, the claim that a wholly "wild" species of *Anopheles* should become an efficient host of a human malarial parasite seems to me so improbable that no evidence other than the demonstration of the parasites in the salivary glands of the mosquito will induce me to accept it.

[1] A Monograph of the Anopheles Mosquitoes of India (first edit.), p. 53–54, 1904.

[2] Centralbl. f. Bakteriol. etc., 1 Abt., Originale, vol. 33, p. 283, 1903.

Lest I be accused of ignorance of the literature, I must state that I have examined a paper by Galli-Valerio in which that author claims to have found oöcysts of the malaria parasites in the stomach-walls of a specimen of *Anopheles boliviensis*.[1] I am unable to accept Galli-Valerio's determination. The specimens were brought to him from the State of Paraná by a friend and were in very bad condition ("qui malheureusement étaient dans mauvais état de conservation"). Even a very close student of American mosquitoes might hesitate to positively identify such specimens, and I am not aware that Galli-Valerio had previously given any attention to American mosquitoes! Dr. Arthur Neiva has rejected Galli-Valerio's results on other grounds: "For the cysts found by Galli-Valerio in mosquitoes preserved in alcohol, which had been sent to him from Paraná, can hardly be looked upon as evidence, because under the circumstances it wou'd be hardly possible to distinguish be'ween hæmatozoans originating from man or from birds."[2]

As to my statements concerning the association of *Anophe'es albimanus* with man, it may be that I have been too positive. But the available observations, and new ones have come to hand since my papers were written, seem to show that my contention has foundation in fact. Naturally the association is not an intimate one, such as it is in the case of *Aedes calopus* and *Culex quinquefasciatus*, and this I indicated in the beginning. The reason is obvious enough in the long period during which the malarial parasites are present in the human circulation. We now know that *Anopheles albimanus* will fly long distances from breeding-places to obtain blood and fly back again to lay eggs, just as do certain species in India which are known to hold a similar relation there. Recently veritable migrations of this nature have been observed.[3] In them the *Anopheles albimanus* were not carried involuntarily by the wind, but were governed in their movements by the food supply for the adults and by the available breeding facilities. Finally there would seem to be a variation in the ratio of *Anopheles albimanus* to other species of *Anopheles*, according to the size of the settlements (within certain limits!) and the consequent available

[1] Notes de parasitologie. Sur la présence d'oocystes chez *Anopheles Lutzi*, Theobald. Centralbl. f. Bakteriol. etc., 1 Abt., Orig., vol. 35, p. 85, 1904.

[2] Contribuição para o estudo dos dipteros. Observaçãos sobre a biologia e systematica das anofelinas brazileiras e suas relaçãos com o impaludismo. Beitrag zur Kenntniss der Dipteren. Beobachtungen über die Biologie und Systematik der brasilianischen Anophelinen und deren Beziehungen mit der Malaria. Mem. Inst. Oswaldo Cruz, Rio de Janeiro, vol. 1, fasc. 1, p. 76, 1909.

[3] Rept. Dept. Sanitation, Isthmian Canal Comm., for January, 1913, p. 43–46.

food-supply in man and animals. I do not think that this difference is explainable by topographic conditions, but I believe that where conditions are otherwise favorable it is governed by the consideration just mentioned.

Finally it must be admitted that, in formulating what I believe to be an important principle, I have been somewhat dogmatic. But the nature of the subject, and, except in the case of the most pronounced examples, the dearth of observations bearing upon it, have made this necessary. If I have caused students to think, to criticise, and perhaps to investigate from a new point of view, I shall feel that I have done something worth while.

——In connection with the foregoing papers Dr. Dyar made the following remarks: "To state the matter concisely, certain workmen engaged in railroad construction in a wild, wooded country, were afflicted with malaria. Dr. Lutz, investigating the outbreak, found no other *Anopheles* present but the species breeding in the epiphytic bromeliads in the forest, *A. lutzii* Theob. He concluded that they were responsible for the outbreak of the disease among the workmen.

At the time of his investigation, it was not known to what a degree of specialization the malarial relation had established itself. It was thought that malaria in man was to be considered as conveyed by *Anopheles* as against other mosquitoes. Lutz's conclusion was, therefore, at the time a natural and plausible one. But we now know that the malarial relation is a highly specialized one. Each kind of malaria is conveyed usually by but one or two species of *Anopheles* in a locality. Often we have in a given locality several species of *Anopheles* present, only one of which is capable of carrying the form of malaria prevalent there. Mr. Knab has pointed out that for such a delicate relation to have established itself, an habitual association of the vertebrate host and mosquito host must have preceded; in other words domestic or semidomestic *Anopheles* only will be found to be malaria carriers. This view renders Dr. Lutz's conclusion less plausible than when viewed in the former light, and, in conversation with Mr. Knab, we had concluded that Dr. Lutz's explanation was probably erroneous. Certainly, in view of recent discoveries, Dr. Lutz's explanation is at least unlikely and unusual and can be accepted only after strict proof.

It seems to me that there are three possible theories to account for the outbreak of malaria observed by Dr. Lutz. First, that the true carrier was overlooked. Second, that the disease was spread

by *Anopheles lutzii* from a latent case among the workmen, and, after the incubation period, first in the mosquito, then in the man, appeared generally among the men as a result of the bites of the infected *lutzii*. Third, that there exists a form of malaria among wild animals in the forest, conveyed by *A. lutzii*, and that man is subject to this disease when specially exposed by residence in the forest and so bitten by the mosquitoes already infected from the wild animals.

In regard to the first alternative, it is difficult to discuss possible sources of error at this distance from the facts, distance both of time and space. It is, however, true that the ordinary malaria carrier may be overlooked, especially if one is possessed by an original idea or theory one wishes to establish. The men may not have been as strictly confined to the camp as supposed, and there are a thousand and one possible chances of error, any one of which may have been operative. Personally I believe that Dr. Lutz was the victim of some error of this kind.[1]

In regard to the second alternative, the chance that a wild species of *Anopheles*, never before having carried human malaria, should be in a condition to do so when malaria cases were presented, seems remote. The condition is possible, but unlikely, and should only be accepted after rigorous proof. The ordinary malarial parasite should be proved to develop in *Anopheles lutzii*.

The third alternative is no more than an interesting possibility. No malarial organisms are known to inhabit wild animals and be transferable to man, though it seems possible that there might be parasites of monkeys, conveyed by forest *Anopheles*, and man perhaps susceptible to them. If such a relation exists, it could be demonstrated by suitable study, but I think we are not entitled to invoke it as an explanation of the present case merely on a possibility.

As between the second and third alternatives, there should be at

[1]It seems to me probable that some ordinary *Anopheles* like *A. albimanus* or *argyritarsis* was really present, but overlooked by Dr. Lutz. It appears from his article that he was too much impressed by the apparent lack of ground breeding-places. He found species of *Janthinosoma* and others present, which are exclusively ground-pool breeders, but he classifies them as occasionally breeding in bromeliads. Apparently he accounts for their presence by their supposed faculty of occasionally so breeding; but this is surely an error. When *Janthinosoma* could be present there must certainly have been abundant opportunity for the breeding of ordinary *Anopheles*.

once evident a difference in the time of appearance of the disease after the men were encamped in the forest. In the second case the disease would appear much later than in the third. But the first alternative might show either a long or short period, according to what the actual mode of infection was, whether by the infection of local overlooked *Anopheles* from latent cases among the men themselves or by infection of the men individually outside of camp by already infected mosquitoes.

But whatever explanation be the true one, the burden of proof rests upon the investigator, in this case Dr. Lutz, and we have the right to expect that proof should be complete or to reject the explanation offered."

——Continuing the discussion Mr. A. H. Jennings said: "In 1909, a survey of the basin of the Chagres River in Panama was made by the engineers of the Isthmian Canal Commission. The parties engaged on this work suffered from malaria and in March of that year I was instructed to make a general investigation of the mosquito fauna of the region with special reference to the sources of malarial infection. The Chagres, Boqueron and Pequini rivers were ascended, the latter to within a few miles of its headwaters, and a careful study was made of mosquito conditions along all of the streams traversed.

Except along their lower courses, the country through which these rivers flow is uninhabited and seldom penetrated by the natives, who venture into the interior during the height of the dry season only. The dry season is so only in name in the country surrounding the sources of the rivers comprising the Chagres system; heavy rains and sudden floods occur even during this season and few days pass without more or less rain.

I found *Anopheles albimanus* Wied., the principal malaria carrier of the Panama region, to be entirely absent from the uninhabited country and this was not from the lack of suitable breeding places, as many such were found. The only species of *Anopheles* present along the upper reaches of the rivers were *eiseni* and *neivai*. The former I found breeding with some freedom in pools at the rocky edges of the rapid streams and also in tree-holes, both situations being characteristic of the species. *Anopheles neivai* was found in the leaf axils of bromeliads and was not found in any abundance.

Both of these species are, in my experience strictly sylvan in habitat, never being found beyond the confines of dense bush. Neither I nor any of the party were attacked by *Anopheles* while traveling up or down the river, during which journeys we camped for a number of nights, entirely without protection, upon the dry shoals at the edge of the river, nor during the whole of my stay near the headwaters. There our protection consisted of a tent fly, open at the sides, pitched at the river's edge and before retiring at night we invariably sat about by the light of lanterns.

In spite of this exposure and the attraction offered by a considerable number of men and unscreened lights, we escaped attack. This may be partly accounted for by the comparative lack of abundance of mosquitoes, but their being unaccustomed to feed upon such hosts as man is also suggested as a factor. Some monkeys are present in these forests but large mammals of all kinds seem to be rare and represented principally by a few herds of peccaries, an occasional tapir and very rarely a deer. This may be a coincidence and the correlation, if it exists, between an uninhabited country and biting habits may be purely local, but it must be remembered that the country which Doctor Lutz describes is also normally uninhabited.

In spite of the conditions I have described, malaria was frequent and severe.

Malaria is endemic and highly prevalent in Panama and the Canal Zone outside of the controlled areas, and the engineers engaged upon the work had been exposed to infection for more or less lengthy periods during their Isthmian experience. The bush-cutters, boat-men, etc., were recruited principally from among West Indian negroes, long resident in the country and from the native population, more particularly from those of a migratory and roving disposition. From the known prevalence of latent malarial infection among the Panamanian population and from the habits of the class of men comprising the laborers attached to the party, as well as the antecedents of the engineers, it is safe to assume that practically every man of the five parties on the work, or possibly 150 men, carried with him into the bush a latent infection which required only hardship and exposure to develop an acute attack of malaria.

Exposure was experienced by all and included, besides great physical exertion, constant wetting from wading streams, often above the waist and every hour of the day and from drenching rains interspersed with periods of hot sunshine.

The conditions did not require the presence of malaria transmitting Anophelines and it is very clear that they played no part in causing the malaria from which the men suffered.

It seems to me that the situation closely parallels the one described by Doctor Lutz, as to character of forest, of men employed, conditions of work and mosquitoes involved, and that probably in that situation, as certainly in the one I have just described, the agency of forest-breeding anophelines in causing the occurrence of malaria may be safely excluded."

The remainder of the evening was devoted to the following paper by Dr. Hopkins and the discussion which ensued.

DISCONTINUOUS GEOGRAPHICAL DISTRIBUTION.

By Andrew D. Hopkins, *Bureau of Entomology.*

The discontinuous geographical distribution of animals and plants is a subject of special interest and importance to the taxonomist, the ecologist, the investigator of technical and economic problems, the student of geographical distribution and of the broader questions of evolution. If the same species or the same genus is established in many widely separated areas of the same country or continent or in the countries of different continents, we want to know something about the controlling factors which have brought it about.

I seems to me that the greatest difficulty to be met with in any comprehensive consideration of the subject from published data is the wide range of difference in the interpretation of specific distinction by taxonomists. There is often a marked difference of opinion on this fundamental question among those who work on the same group, but, when we consider the great difference in the interpretation of the range or limits of specific distinction among specialists in entomology or zoology, or in the entire field of biology, the complications in the difficulty of determining a reliable basis for comprehensive study or conclusions is overwhelming; in fact is prohibitive of reliable results. The genus of one author becomes a

subgenus species or subspecies of others or even a variety in the mind of the extremist who insists on the widest range for specific and generic characters. In an effort to define the distribution of such a complex, what are we going to do? Who are we going to accept as the authority? Naturally we will be inclined to accept the one who is nearest in accord with our individual opinions. If we are familiar with the genus or species, as the case may be, perhaps our opinion will be worth something as to the range of distribution, but suppose we are not familar with the genus or species of one author although we may be an authority on some other group, and we want to compare the distribution of his concepts with what we consider be to a species in our special group. In such a case our conclusions as to the governing factors in the distribution, will not be worth much beyond those based on our own interpretation of a species and personal knowledge of the range in its distribution. Yet broad generalizations have been based on just such uncertain data by biologists and zoologists in the past and will be in the future until some common standard is established.

If the leading biologists would meet on some common plane of reasoning by withdrawing from their fortified positions of extreme opinions (under a flag of truce if necessary), and would be guided by a sincere desire to get together on some of the more essential evidences and facts as to the units for comparison, something of real importance and value would be accomplished.

There has been a great deal of speculation on the probability that certain widely separated land masses of two continents were connected at some remote period, because of the presence in both areas of the same or similar genera and species.

The theory of circumpolar distribution during periods of uniform mild climatic conditions and of separations and isolations during the frequent glacial disturbances is a most attractive one considered by many to be a simple explanation of the occurence of the same genera and species in the boreal and temperate zones of two continents.

Undoubtedly the periods of glaciation which prevailed at various geological times in different parts of the world have had a marked influence on the distribution of plants and animals and especially certain discontinuous distribution. It is evident, however, that a number of examples in glaciated areas, in addition to those in areas out of the range of glacial influences, can not be explained by the glacial theory of distribution.

In looking for examples of discontinuous distribution, I must naturally give first consideration to insects and to the group of insects which has received my special attention, namely, the Scolytid beetles.

According to a system of classification which will soon be published, these beetles represent a superfamily, with representatives in every part of the world where woody plants grow. The four families are represented in all of the great faunal areas, while the subfamilies, genera, and species become more and more restricted with the descending rank. There are, of course, some notable exceptions to be found in genera and species which are more or less cosmopolitan. There are, on the other hand, a great many genera and species which are, so far as known, exceedingly restricted in their distribution.

While, as a rule, species and groups of closely allied species follow the distribution of their hostplant species, there are examples of species of insects which are more restricted in their distribution than that of their host plant.

There are also a great many examples of allied plant species in different countries being the hosts of the same genera and very similar species of insects. Among these, there are to be found some of the more striking examples of discontinuous distribution, especially under the broader conception of a species. Under a more restricted conception, the number of such examples is greatly reduced, so that under this conception the subject would resolve itself into one of discontinuous distribution of closely allied species.

The subject of so-called paired or parallel species is of special interest in connection with a study of geographical distribution. There are some striking examples of paired species in the genus *Dendroctonus* which if they occupied the same local faunal area would be difficult to separate on account for their close resemblance in structural characters. These paired species are *brevicornis* and *barberi*, *frontalis* and *arizonicus*, *mexicanus* and *parallelocollis*, *monticolæ* and *ponderosæ*, *piceaperda* and *engelmanni*, *punctatus* and *micans* and *terebrans* and *valens*. In each case the pairs are more or less widely separated from each other in their geographical distribution, as for example; *micans* of northern Europe and *punctatus* of the Appalachians of North American; *frontalis* of the southern states and *arizonicus* of Arizona; *barberi* of Arizona and New Mexico and *brevicornis* of the Pacific slope states, Idaho, Montana and part of Wyoming; *ponderosæ* of the central and southern Rocky Mountains and *monticolæ* of the northern Rocky Mountains and Pacific Slope.

There are a large number of similar cases of so-called paired species in other genera and the supposition that some of them are one and the same species has led to considerable confusion relating to the true range of a species. Between North America and Europe we have several examples such as *Xyleborus pyri* of America and *Xyleborus dispar* of Europe, *Dryocœtes autographus* of Europe and

Dryocœtes septentrionis of the western coast and Alaska of America, *Xyloterus lineatus* of Europe and *Xyloterus bivittatus* of eastern and western North America, *Hylurgops glabratus* of Europe and *Hylurgops pinifex* of eastern America. There are many others common to two or more countries which superficially seem to be the same things and if so would come under the head of discontinuous distribution of species.

Some of the most important examples in discontinuous distribution of species are to be found in a leading article by Professor Kellogg in the American Naturalist for March, 1913, on "Distribution and Species-Forming of Ecto-Parasites." This has reference to the curious and most interesting bird lice on which Professor Kellogg is a special authority. This writer states: "There appears to be a plain tendency for a single parasite species to be common to two or more related host species even though these hosts be so widely separated geographically and so restricted to their separate geographical range that all possible chance of contact between individuals of the different host species seems positively precluded."

Numbers of examples are given. Professor Kellogg thinks that this remarkable discontinuous distribution is due to descent from a widely distributed common ancestor.

Many interesting examples of discontinuous biological islands characterized by the same or very similar species, are to be found in high, isolated mountains or mountain ranges, and low bogy areas, and so-called ice caves, regular caves, etc. Some of the boreal islands are restricted to a few square rods. Whenever in these islands the climatic conditions and the general environments are similar the same or similar genera and species of plants and animals occur, which in many cases are separated by hundreds or even thousands of miles from the nearest area of continuous distribution.

Some of the causes of discontinuous distribution may have been due to the separation of once continuous land masses, fluctuating climatic conditions of circumpolar areas from similar conditions throughout to radical local differences due to glaciation and ocean currents. There are also a great many examples of artificial or accidental introductions, but I am more and more inclined to the opinion that parallel evolution from a common primitive ancestral base under long continued, similar environments has been a very important factor in establishing what are considered to be the same species, and closely allied species in widely separated areas of the world. Therefore it seems to me that we have in this principle of parallel modification and evolution a simple and plausible explanation for many of the puzzling features in the geographic distribution of genera and species of plants and animals.

——In discussing this paper Mr. Caudell spoke of the Mantid genus *Brunneria*. This genus was described by Saussure in 1869 from a species from Argentina and within the next two years he added two more species, both from Brazil. A quarter of a century later Mr. Scudder described *B. borealis* from Texas in the United States. Representatives of this genus have never been found in the intervening countries of Mexico and Central America, though future collecting may yet show the genus to occur there. The northern species, five speciments of which are in the National Museum Collection, have been compared directly with the type species from South America and appear to be perfectly congeneric with it.

Accidental introduction was cited as a potent factor in discontinuous geographical distribution. It was suggested that had the recently introduced Asiatic mantis, *Tenodera sinensis*, been brought over by some early explorer it might have become well distributed over our northeastern states and have been described by some early American entomologist as a new species, its relationship to the Old World form not being suspected. Indeed, in a case like this, were the known New World four thousand or more years old instead of four hundred, the species would very likely have been changed by climate and environment into a distinct variety or species or even genus.

——In reply to Mr. Caudell, Mr. Banks said it made no difference whether these genera were used in the present sense or divided; the fact would still remain that one genus or several allied genera had a certain distribution. He also said that though there were many insects distributed by commerce, the distribution of the genera he had considered was effected long before the existence of man.

Meeting of May 1, 1913.

The 268th regular meeting of the Society was entertained by Mr. W. D. Hunter in the Sængerbund Hall, 314 C street N.W., on the evening of May 1, 1913. In the absence of the Recording Secretary the President asked Mr. Rohwer to read and record the minutes. There were present Messrs. Baker, Banks, Barber, Böving, Burke, Busck, Caudell, Cory, Craighead, Cushman, Duckett, Fisher,

Gahan, Gill, Greene, Heidemann, Heindrich, Hood, Hopkins, Hunter, Kirk, Knab, McIndoo, Malloch, Middleton, Myers, Pierce, Popenoe, Rohwer, Schwarz, Shannon, Snyder, Turner, Walton and Wood, members, and T. D. A. Cockerell and W. T. N. Forbes visitors. President Busck occupied the chair.

The minutes of the preceding meeting were read, and with the insertion of the names of Dr. Adam Böving and Mr. H. B. Kirk as having been proposed for active membership at the last meeting were approved.

The Corresponding Secretary read a letter from Dr. David Sharp thanking the Society for electing him as an honorary member.

The Editor stated that the manuscript for the second number of volume XV was in the hands of the printer and that it was intended that it would be out on June 6. He also added that he had attended the meeting of the Editors and Secretaries of the Washington Academy of Science and affiliated societies, the purpose of which was to obtain suggestions as to the improvement of the Journal of the Academy. It had been suggested that a department of news and personal notices be included. No action was taken on this.

Dr. Adam Böving and Mr. H. B. Kirk were elected active members.

The first paper of the evening "Remarks on Fossil Insects" was presented by Professor T. D. A. Cockerell.

REMARKS ON FOSSIL INSECTS.

By Prof. T. D. A. Cockerell.

[Author's Abstract.]

The known insects, as well as the plants, can be divided into two great groups, the ancient and the modern. The ancient groups were represented in the Palæozoic and earlier part of the Mesozoic. During the Mesozoic the dicotyledonous plants, even including genera still common, appeared, and the flora has not changed its general facies since. We know very little about the later Mesozoic insects but the Tertiary insects are so thoroughly modern in type that there is no doubt that the modern series of insects arose during the Mesozoic. At the same time, it must be noted that of the groups prevalent today, some are very much older than others. The statement has been carelessly made, that bees existed during the Mesozoic. As a matter of fact, none of the few known Mesozoic

Hymenoptera are bees, or at all nearly related to them. It is possible that there were Mesozoic bees, but if so, they have still to be found. In the upper Cretaceous of Colorado, the speaker had found fairly large pieces of amber, but careful search in it has not produced any plant or insect remains. Insect-bearing amber from the Cretaceous would of course be of extraordinary value, and might be expected to throw light on many entomological problems. In this country there are extensive insect bearing beds of Eocene age in Wyoming, and especially in the region about the boundary between Colorado and Utah. Mr. Earl Douglass, who has recently come from that region, stated to the speaker that the insect bearing deposits he had examined were extremely rich, but nearly all of the insects were small. It is hoped to visit these deposits at some future time, and as they are much older than either the Prussian amber or the Florissant shales, it is expected that very interesting materials may be found.

The species from Eocene horizons described by Scudder, though quite numerous, must represent only a small part of the fauna which has been preserved.

The Prussian amber insects are extremely numerous, and many of them so beautifully preserved that it is possible to count the palpal joints, and see many other details of structure. They have about 100,000 specimens in the collection at Königsberg. The speaker, some years ago, described the bees of the Königsberg collection, and found that all the genera were extinct, while some of the other Hymenoptera, as for instance, two species of *Crabro*, belonged strictly to living genera. The amber insects, after being much neglected, are now being carefully worked up, and attention must especially be called to Ulmer's magnificent monograph of amber Trichoptera. Dr. W. M. Wheeler has just completed the study of the amber ants, and his paper will be of the greatest interest, showing a curious mixture of quite modern Palæarctic types, with many remarkable genera of Indo-Malay affinities.

The Florissant beds, in which the speaker has principally worked, are of Miocene, probably Upper Miocene, age. The species known from there now considerably exceed a thousand, and it becomes possible to draw some conclusions from the absence as well as the presence of certain groups. It is very singular that no true Muscidæ and no Tachinidæ have ever been found; while on the other hand Nemestrinidæ were well represented, and there were two species of tse-tse fly, *Glossina*. The Bombyliidæ and Aphididæ seem, though numerous, all to belong to extinct genera but in some other families, equally common, all or nearly all the genera appear to be still living. It has appeared not necessary, for example, to propose a new generic name or any one of the Asilidæ. Tipulidæ

are very abundant and the modern genus *Tipula* is very rich in species. No recognizable Culicidæ have been seen, except a single egg which certainly appears to belong to this group. Among the bees, some of the genera are extinct, but most are still represented in Colorado in marked contrast with the bee fauna of amber which is considered to be much older. Some of the wasps greatly resemble living species, and the same is true of the sawflies. There are however some remarkable extinct types of sawflies. The sawfly fauna as a whole is found by Mr. Rohwer to resemble that of the eastern United States, herein agreeing with the flora, which has much in common with that of the uplands of the southeastern states. Thousands of specimens of ants have been collected, but they have not been described. They are in the hands of Dr. W. M. Wheeler. The beetles are being worked up by Prof. H. F. Wickham, who visited Florissant last year and made a large collection. Weevils are extraordinarily abundant, and include some very curious extinct generic types. Certain families are unaccountably absent or at least have not been found; perhaps the most noteworthy being the Histeridae, which would be readily recognizable. It at first seemed that small beetles were scarce, but Professor Wickham has gone over a quantity of the best shale with a lens, and has discovered a number of minute things which would be overlooked in the field. Perhaps the most interesting discovery among the Coleoptera is a genus with two species, apparently referable to the Paussidæ. On the whole it seems that the Florissant shales were laid down at a time when Bering Strait was dry land, and the old world fauna was invading North America; but the Isthmus of Panama was still under water, so that there is no clear indication of any strictly neotropical fauna or flora in the shales.

The Miocene beds at Œningen, or rather Wangen, in Baden, appear to be approximately of the same age as those of Florissant, and carry a very similar fauna. These beds were visited by the speaker some years ago, and while some good plants, molluses and fish were collected, it was found impossible to get at the good insect-bearing beds, which are covered with earth and rock on which vegetation is growing. The fossils were obtained when the rock was quarried, and the quarries have been neglected for about thirty years. It is evident that there are vast beds of fossils at Wangen still untouched, just as there are at Florissant and it is surprising that no one has taken enough interest to continue the work of Heer. It would not cost any very great sum to open up the beds and collect more fossils, especially since labor is cheaper than in Colorado, and more easily obtained. The locality is a charming one overlooking the north bank of the Rhine. Heer's Œningen fossils are mostly in the Museum of the University in Zürich where the speaker examined them.

Many of them are very beautiful. Numerous fossils from the same locality were seen in the Museum at Constance.

From the Miocene to the Pleistocene, we know little of the American insect fauna; but the interglacial clays have yielded a number of Coleoptera, which Scudder has described, finding them distinct from, but closely allied to, living species. As the Pleistocene plants are known to be mostly living species, it appears from this that the species of insects change more rapidly than those of flowering plants; but generic changes among insects appear to be very slow. Most of the multitudinous species of insects which perplex entomologists may be said to be due to a sort of shuffling of the characters which have been inherent in their several generic types for a very long while.

——In discussion of Professor Cockerell's paper Dr. Gill objected to the liberal use of the word cockroach and added that he had argued this point with the late Dr. S. H. Scudder. His objection to Professor Cockerell's use of the term was that the ancient insects called cockroaches were not the cockroaches of today; they do not belong to the family Blattidæ or even to the same order as the modern cockroaches which did not appear until the Upper Cretaceous. Dr. Gill added that he had made the same objection to the common liberal use of the word "horse" as applied to the ancestors of the horse, stating that the three-toed horse was not a horse or even closely related to the modern *Equus*—indeed it belonged to an entirely different group.

Dr. Gill added that among most animals there was a great dif ference between the ancient types represented in the Palæozoic formation and those which come in the Cretaceous and newer rocks. So marked is the difference that for mammals the modern fauna has no family in common with the Eocene except possibly the Didelphidids. The difference is not so well marked in the molluscs as they have come through with but little change since the Cretaceous, and even earlier, for there are several freshwater types, as viviparids, melaniids, unionids, in the Jurassic beds which on the characters available can hardly be distinguished from forms living today. The mammals are entirely different and have evolved very rapidly, the fish less rapidly, and the molluscs more slowly, so these great goups may serve as chronometers for the including rocks.

——In further comment on Professor Cockerell's paper Mr. Banks emphasized the importance of the amber insects and stated that some of them which he had seen were in even better condition than the modern museum specimens, referring mostly to the Psocids. As an example of the fragmentary and unsatisfactory nature of most Florissant fossils he commented on the recent description of a Phryganeid by Professor Cockerell and stated that this family could only be separated from the closely allied Limnophilidæ by the male palpi, which were not preserved. He also commented on the value of the recent work on amber Trichoptera by Ulmer.

Mr. Banks added that in the fossil fauna of Florissant are groups of insects which occur today only in warm countries, and also groups which occur today only in cold countries. And he considered that it is possible that in Miocene times one or the other of these groups were accustomed to either a warmer or a cooler climate. For example, if we collected 5500 species of insects around Washington we would undoubtedly have some insects which belonged more properly to the tropical or subtropical regions, viz., the wheel bug. To him the most discouraging thing about fossils is that the story breaks off just at the most important place and that if some could be discovered which would bridge the gap between the Palæozoic and Mesozoic some interesting points might be obtained, for it was during this long period that most of the orders had their beginning.

——Dr. Hopkins stated that he was much interested in Professor Cockerell's remarks about the insects in Florissant deposits and those of the interglacial clays. He added that he examined Scudder's types of Florissant Scolytidae and found that they were not all Scolytids but that those which could be recognized as belonging to this family appeared to belong to modern genera. He stated that one species referred to by him in Psyche[1] under *Hylesinus* had double eyes, but later he found that it belonged to another genus not represented in America but with its nearest ally in the Philippine Islands. He mentioned that he had examined Dr. Scudder's famous fossil stick from the interglacial clays and that from the gallery he had recognized the work of a *Phlœosinus* and suggested that it was allied to a Pacific Coast species, and that Scudder

[1] A. D. Hopkins. American Fossil Coleoptera Referred to the Scolytidæ. Psyche, vol. 9, 1903, p. 64.

had arrived at the same conclusions in regard to many of the other Coleoptera from the same clays.[1]

Dr. Hopkins remarked that, in his opinion, it is not safe to draw conclusions on any evidences of evolution from fossil forms, stating that he believed that as a rule only the highly specialized species were preserved and that the small and less specialized forms from which present species may have evolved, were not preserved. He added that he was glad to have the additional evidence on parallel evolution brought out by Professor Cockerell in his reference to the resemblance of Florissant forms to those of other countries and continents.

The second paper, "Efficiency of a Tachinid Parasite, on the Last Instar of Laphygma" was read by Mr. Walton.

EFFICIENCY OF A TACHINID PARASITE ON THE LAST INSTAR OF LAPHYGMA.

By W. R. Walton, *Bureau of Entomology.*

During the latter part of August, 1912, an infestation of *Laphygma frugiperda* occurred on the grounds of the Department of Agriculture at Washington, D. C., in close proximity to the quarters occupied by the Bureau of Entomology. Observations indicated that the larvæ were parasitized in a high degree by Tachinid flies. The occasion was therefore grasped as an opportunity for securing data on the relative efficiency of these parasites in the last instar of the caterpillar. It has been remarked by various observers that caterpillars frequently cast off the eggs of Tachinids with the pellicle during ecdysis, before they have hatched or at least before the young larvae have been able to gain entrance through body walls of their host. But as the last instar of some caterpillars is of longer duration than the earlier moults, and as in this stage the larvæ are, on account of their larger size, method of feeding, etc., more open to the attack of Tachinidæ, it seemed possible that oviposition might prove more effective in this instar than in the earlier moults.

Accordingly efforts were made to secure information on the following points: (1) Effectiveness of parasitism; (2) maximum number of adult Tachinids to issue from one individual of host; (3) what effect if any had the deposition of supernumerary eggs on

[1] A. D. Hopkins, Contributions to Canadian Palæontology, vol. II, pt. II, Canadian Fossil Insects, Appendix: Work of the prehistoric Scolytid, *Phlæosinus squalidens* Scudd. pp. 91–92., plate XIV.; XV.

the development of the resulting adult flies; (4) what species of Tachinidæ were involved.

The only species reared was *Winthemia quadripustulata* Fabr. Fourteen caterpillars were selected, each bearing from one to twelve of the conspicuous eggs of this fly. Each larva was placed in a single small cage and kept under similar conditions. Two of them designated respectively as F and G died after entering the ground from causes undetermined, no flies issued from them, they may therefore be eliminated from consideration. In the remaining twelve cases parasites emerged from each, resulting in the destruction of the host, thus apparently indicating a very high degree of effectiveness for this species of parasite on the last instar of *Laphygma*.

The largest number of flies to issue from any one host was three and this occurred only in one instance. In five cases two flies emerged. In the remaining six but one fly each resulted. It may be seen by consulting the appended table that the largest individuals each and all emerged from hosts which had borne but a single egg of the parasite. In these cases designated as A, G and L the flies averaged 10.5 mm., all males. In case M (the only example remaining in which but two eggs were borne by the host), the resulting fly, a female, measured 9 mm., indicating apparently that there is a distinct economic loss to the fly when more than one egg is deposited. And this idea is well borne out by the results obtained from the other examples where a large number of parasitic eggs were found. In cases C and D where six eggs occurred the resulting flies, two males and one female, averaged 8.5 mm. In cases I and N where 7 eggs occurred we have an average of 8.5? (two males and one female). In cases E and K where as many as 12 eggs were present on the host the average is but 7 mm. (three males and one female). In both the latter cases but two adults issued in each cage. It appears obvious from the foregoing that in this species at least the size of the adult fly may bear a direct relation to the number of eggs deposited on the host caterpillar by the parent. It would be interesting to know what effect if any this diminishment in size has upon the reproductive powers of the resulting individuals. The three largest individuals are all males. But the fact that size bears no relation to sex in this species is apparent from the results here obtained, that is to say, the two smallest individuals reared (see case K) are also males.

We might speculate at length upon what occurs in those caterpillars where several eggs are deposited. But one thing is plainly evident, namely, that a struggle for survival ensues among the parasites. One result of which is diminished size and therefore possibly a lessening of reproductive vigor in the issuing adults.

Some time subsequent to the preparation of this manuscript it was my privilege to see Dr. J. C. Nielson's most interesting paper[1] relative to his experiments with *Tachina larvarum* Linn. (a species very closely related to, if not identical with, our *Tachina mella* Walk.) and its parasitism on *Zygaena filipendulae* in Denmark. My experiments while conducted on a much smaller scale seem to indicate results which are in the main parallel with his. That is to say, the deposition of supernumerary eggs resulted in a diminution of size in the resulting parasites. However, he says, "in cases where several flies emerged from the same host; their size was not equally reduced, one or two of them not differing in size from that of flies which had developed solitary, the remainder being undersized." He does not, however, state whether the solitary specimens mentioned were those resulting from the deposition of one, or more than one egg on the host caterpillar.

The detailed results of my somewhat limited investigation are summarized below in the appended table:

Cage Symbol.	No. of eggs on caterpillar.	Entered earth.	Date parasites issued.	No. of flies issued.	Length mm.	Sex.	Remarks.
A.....	1	Aug. 28	Sept. 12	1	11	♂	
B.....	4	Aug. 30	Sept. 12–14	3	8–7–7	♂ ♀ ♀	
C.....	6	Aug. 30	Sept. 12	2	8–9	♂ ♂	
D.....	6	Aug. 30	Sept. 14	1	8	♀	
E.....	12	Aug. 30	Sept. 11–14	2	8–8	♂ ♀	
F.....	9	Aug. 30	0	0	—	—	Died in earth.
G.....	2	Aug. 30	0	0	—	—	Died in earth.
H.....	9	Aug. 30	Sept. 12–14	2	7–7	♂ ♀	
I.....	7	Aug. 30	Sept. 11	1	9	♂	
J.....	1	Aug. 30	Sept. 14	1	10	♂	
K.....	12	Sept. 1	Sept. 12	2	6–6	♂ ♂	
L.....	1	Aug. 30	Sept. 12	1	10	♂	
M.....	2	Aug. 30	Sept. 15	1	9	♀	
N.....	7	Aug. 30	Sept. 12–14	2	8	♂ ♀	

——In discussing this paper Mr. Pierce stated that in the South he had found *Chelonus texanus* Cresson (det. Viereck) which laid its egg in the egg of *Laphygma* to be a much more efficient parasite

[1] Undersogelser over entoparasitiske Muscide larver hos Arthropoder af Dr. J. C. Nielson, Saertryk af Vidensk. Medd. fra den naturh. Foren. Bd. 64 p. 215–248.

than the Tachinid mentioned by Mr. Walton, stating that *Chelonus* caused a total mortality and emerged from the third or fourth instar of *Laphygma* larvæ.

——Mr. Busck asked Mr. Walton if he had been able to find any remains of the Tachinid larvæ in the *Laphygma* larvæ on which more than one egg was laid, and whether it had been ascertained if the Tachinid parasite was crowded out in the larval or egg stage.

Mr. Walton said that he had no evidence.

The third paper, "The Ovipositor of *Parandra brunnea* Fabr." was read by Mr Snyder.

THE OVIPOSITOR OF PARANDRA BRUNNEA FAB.

By T. E. Snyder, *Bureau of Entomology.*

The family Spondylidæ is of considerable interest in that there is quite a little doubt as to its proper position in the classification of Coleoptera. Indeed, some authors consider the genera *Parandra* Lat., *Spondylis* Fab. and *Scaphinus* Lec., which LeConte and Horn[1] have placed in a separate family, either as belonging to the family Cerambycidæ or as aberrant Cerambycidæ. LeConte and Horn have divided the family Spondylidæ into the subfamilies Parandrinæ and Spondylinæ the former embracing the genus *Parandra* Lat., the latter the genera *Spondylis* Fab. and *Scaphinus* Lec. As LeConte states,[2] this family "might be regarded as representative of a family nearly extinguished in the lapse of time," for the species are "very few and highly discrepant."[3] Species of the genus *Parandra* Lat., like those of genera of the family Prionidæ have the prothorax margined and as there are many characters to indicate relationship, it has been included in this family by some authors as an aberrant form. The larva of *Parandra brunnea* Fab. is typically Cerambycid-like in form and has characters which, according to Mr. F. C. Craighead of the Bureau of Entomology, place it between the groups *Prionini* and *Asemini*. The larva of *Spondylis buprestoides* Linn.,[4] a European species, according to Judeich and Nitsche, is similar to Cerambycid larvæ in form. The

[1] Classification of the Coleoptera of North America, Washington, 1883, p. 264.

[2] Journ. Ac. Nat. Sci., 2nd Ser., vol. II, 1851, p. 99.

[3] Sharpe, D. "Insects." Pt. II, pp 287–8, "The Cambridge Natural History," vol. VI, 1901.

[4] Lehrbuch der Mitteleuropaeischen Forstinsektenkunde, 2, I, 1889, pp. 570–71.

ovipositor of species of the genus *Parandra* Lat. is unlike the fleshy ovipositor of most of the Cerambycidæ as it is heavily chitinized and highly specialized, being adapted to actually insert the eggs in wood. The ovipositors of species of the genera *Spondylis* Fab. and *Scaphinus* Lec., however, more closely resemble those of the normal Cerambycidæ. The ovipositor of *Parandra brunnea* Fab. (fig. 1) is operated by being extended by the contraction of the muscular attachment of a chitinous rod and an invagination, sternite VIII. The 8th abdominal tergite overlaps the 7th and the rod and sheath is attached by muscles to the 7th tergite and the 8th sternite. The function of the ovispositor, which terminates in

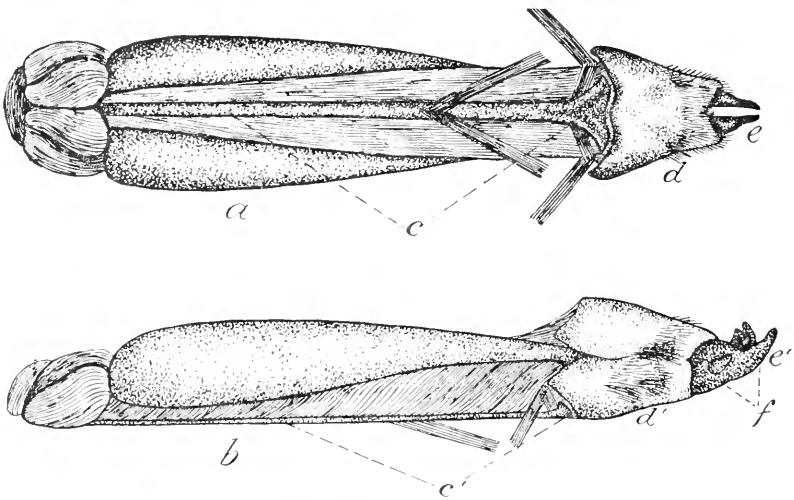


Fig. 1. Ovipositor of *Parandra brunnea* Fabr.; a, ventral view; b, lateral view of same, showing c, c′ rod; d, d′ invagination; e, e′ prongs; f, foveae.

three pair of up-pointing prongs or teeth, the inner pairs or molars of which are movable, is probably to drill or rasp out a pocket for the egg. The muscles at the base of the ovipositor enable it to be twisted about. The ovipositor of *Prionus laticollis* Drury (fig. 2) is also chitinized and is a modification of the normal fleshy ovipositor of Cerambycids.

The nomenclature is omitted as Dr. Hopkins and Dr. Böving will later correlate the various parts of the ovipositor of *Parandra brunnea* Fab.

The eggs of *Parandra brunnea* Fab. are inserted in decaying wood or even in moist wood where there is only incipient decay. A chestnut telegraph pole in which eggs were found was set in the

ground near Anacostia, D. C., and had been standing but little over a year. A number of the eggs are inserted proximately, often in the

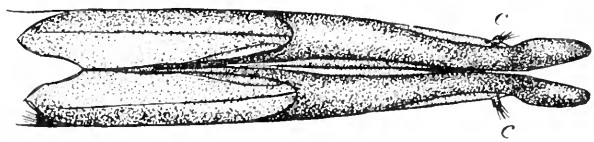


Fig. 2. Ovipositor of *Prionus laticollis* Drury, ventral view c, c' *cerci*.

pores which are rich in food substances. The larvæ upon hatching excavate shallow longitudinal burrows, then enter the wood transversely. This habit of living in wood below the surface of the ground is shared with species of the Prionidæ and doubtless the earth about the wood serves the purpose of retaining moisture as does the bark upon logs under which many beetles insert their eggs.

The drawings are by C. T. Greene.

The following papers were accepted for publication:

A NEW SPECIES OF SIMULIUM FROM TEXAS.

By J. R. Malloch.

Simulium distinctum, new species.

Male: Black. Antennæ yellow, generally more or less brown toward apices; face with silvery pollinosity; palpi and proboscis black, or brown. Mesonotum deep velvety black, with two silvery pollinose, slightly curved lines, which are broadest at anterior extremities, and extend the whole length of disk, meeting at the posterior margin with a cross band of the same color; side margin yellowish, with silvery pollinosity, prescutum yellow; pleuræ opaque gray, yellowish below wing base on the membranous portion of mesopleura; scutellum black; post-notum black with a silky lustre. Abdomen with basal scale velvety black or brown-black, the segment below it yellow, the succeeding three segments deep velvety black; next segment sometimes more or less yellowish, and almost entirely covered with silvery pollinosity, which is also noticeable on sides of next segment; apical segments and hypopygium black. Legs yellow; fore coxæ slightly, mid and hind coxæ distinctly grayish; hind femora with apical half blackened; fore tibiæ darkened towards apices and, like the other tibiæ, whitish on dorsal surfaces; hind tibiæ with apical half black; fore tarsi black; mid and hind tarsi with apices of first and second, and whole of third to fifth joints black. Wings clear. Halteres yellow.

Head normal in shape, the upper eye facets much larger than the lower; face with a few black hairs. Mesonotum with golden pilosity, which is

not very pronounced, and only visible, under a moderate magnification, on the pale stripes, though more conspicuous on posterior and lateral margins; scutellum with decumbent golden pilosity and upright yellowish hairs; pleuræ bare except for the usual tuft below wing base, which is not conspicuous, and confined to upper angle. Basal abdominal fringe yellow, other abdominal segments weakly haired. Legs strong; surfaces with golden pile, and scattered black hairs, which are most conspicuous on dorsal surfaces; fore tarsi slender; basal joint more than twice as long as second; the paired apical hairs present on joints 1 and 3, but not conspicuous; hind metatarsus not as broad as hind tibia, and distinctly longer than the other four tarsal joints together; claws trifid, wing venation normal.

Length, 1.5 mm.

Type: Cat. no. 15958, U. S. N. M.

Locality: Devils River, Texas, May 5, 1907, at light, (Bishopp and Pratt)

Female: In color very similar to the male, but the yellow is more predominant. The frons and face are thickly covered with a pale lavender-gray pollinosity; the antennæ are slightly darkened at base; and the palpi are black. Mesonotum with the appearance of having three deep black stripes on a brownish-yellow ground, the intervening spaces covered with thick pollinosity similar to that on frons, and the lateral margins also distinctly pollinose; pleuræ black, anteriorly and posteriorly yellow-brown, with silvery pollinosity; scutellum brown, gray pollinose, post-notum black, with silky lustre. Abdomen with basal scale yellow; segment below scale silvery, on apex, laterally; the other segments yellow, more or less obscured with brown, and with three rows of black spots. Legs colored as male. Wings similar to male. Halteres yellow. Frons convergent anteriorly, at upper angles almost twice as wide as at lower; surface hairs sparse, pale; face distinctly longer than broad, its breadth slightly more than equal to breadth of frons at lower margin, haired as frons. Mesonotum with the pilosity very short, close and hairlike, yellow in color; scutellum with distinct, decumbent yellow pilosity and longer upright yellow hair. Basal fringe of abdomen short, yellow. Legs haired as in male; claws simple.

Length, 2 mm.

Same data as males. One specimen.

Another specimen with label, Victoria, Tam., Mexico, December 10, (F. C. Bishopp), though smaller agrees in other particulars with the allotype. I do not know of any recorded occurrence of *Simulium* at light, and it seems strange that species which normally prefer the sunshine should be attracted in this manner.

TWO NEW SPECIES OF BORBORIDÆ FROM TEXAS.

By J. R. Malloch.

Leptocera (= Limosina) mitchelli, new species.

Male: Black, shining, but not glossy. Third joint of antennæ, face, and cheeks more or less distinctly reddish brown. Legs brownish. Wings smoky; veins brown. Halteres brownish yellow.

Frons about as long as broad, opaque except on orbits; 3 outwardly directed, orbital bristles present; the center rows consist of 4 bristles each which are of about equal length; antennæ normal in size and shape; arista nearly bare, in length about $1\frac{3}{4}$ the width of frons; cheek about equal in height to the width of third antennal joint; vibrissa strong, situated slightly above mouth margin; posterior to the vibrissa there is a short bristle situated about midway from lower margin to eye margin, and the usual marginal bristles are distinct; face concave; eyes elongate oval. Mesonotum with only one pair of prescutellar, dorso-central bristles, and the disk thickly covered with short setulæ; pleuræ glossy; sterno-plura with two bristles neither of which is exceptionally long; scutellum with four marginal brisles and the disk covered with short setulæ. Abdomen with numerous surface hairs; hypopygium large, its surface covered with short hairs. Legs covered with short hairs; mid tibia with four to five bristles on the dorsal surfaces, the pair at about apical third strongest, and one ventral bristle at below middle; basal joint of hind tarsus barely longer than broad; second distinctly longer than broad. Wings with first costal division two-thirds as long as second; second subequal with third, or slightly shorter; basal section of third vein not half as long as last section of second; outer cross vein upright, at slightly more than its own length from inner; last section of third vein straight, ending before wing tip; costa extending well beyond end of third vein; fourth and fifth veins indistinct from outer cross vein.

Length, 1 mm.

Type and *paratypes:* Cat. no. 15972. U. S. N. M.

Locality: Victoria, Texas. 10–9–1907. (September?) (J. D. Mitchell) "on *Bumelia lanuginosa.*" Five specimens.

Allied to *ferruginata* Stenh., which is cosmopolitan in its occurrence, and is common in North America.

Leptocera (= Limosina) approximata, new species.

Male: Black-brown, subopaque. Second antennal joint, viewed from above and the side, velvety opaque black; cheeks and face yellowish-brown. Pleuræ and legs yellow-brown. Halteres yellow, knob brown. Wings clear.

Frons occupying almost the entire width of head, fig. 2, center stripe shining, the narrow stripe on either side opaque orbits shining, lateral margins of center stripe with a row of hairs, orbits covered with short

hairs, the bristles hair-like, and confined to the upper half; antennæ of moderate size, directed outward, second joint with short apical bristles, third joint with pale pilosity; arista slightly longer than width of frons, hair-like, pubescence distinct, white; face slightly retreating in profile, eye small occupying less than one-half the length of head from vertex to anterior margin, distinctly higher than long and in height equal to height of cheek; 2–3 short bristles below anterior lower margin of eye; the marginal bristles on cheek regular, distinct, and increasing in length anteriorly.

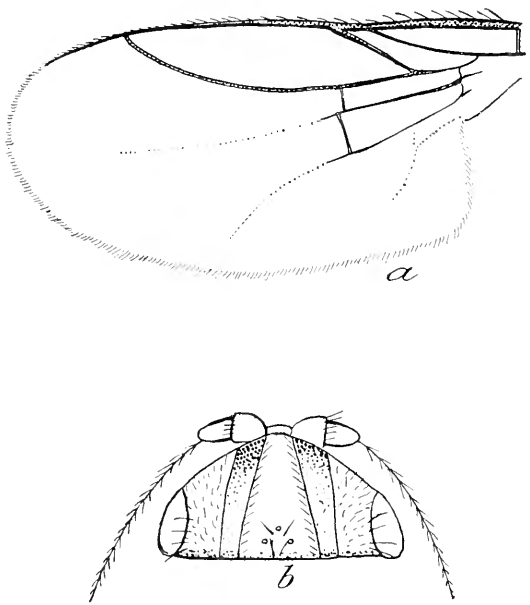


Fig. 1. *Leptocera approximata*, n. sp.; a, wing; b, head, antennae, face and cheeks.

Mesonotum with short discal pale hairs, the bristles confined to a row (5–6) in front of scutellum; marginal bristles weak; scutellum flattened on disk, broad, rounded in outline, disk bare, margin with four widely separated bristles of equal length. Abdomen not longer than thorax; hypopygium knob-like, the surface covered with short hairs. Legs normal; dorsal surface of mid tibia with 4–5 bristles as in most species of *Limosina*. Wing as figure 1a.

Length, 5 mm.

Type: Cat. no. 15973. U. S. N. M.

Locality: Dallas, Texas. August 30, 1907, reared from cow manure, (F. C. Pratt), Hunter no. 1611–19.

The peculiar frons should readily separate this species from any of the few species that are allied to it in wing venation.

NEW EXOTIC NEUROPTEROID INSECTS.

By Nathan Banks, *Bureau of Entomology.*

Included below are a few miscellaneous descriptions of new exotic Neuropteroid insects which I have prepared from time to time while going over parts of my collection.

EPHEMERIDÆ.

Ephemera vedana n. sp.

Yellowish; pronotum with a dark stripe each side reaching back to above base of wings. On dorsum of abdomen, each segment has a pair of dark lines each side, the upper one the wider, except on the penultimate segment where there is one stripe each side, and a submedian pair within, this submedian pair of lines is often indicated on the other segments; last segment has a round black spot each side at base, and on some of the basal segments is a median dark spot. Venter with dark line each side, and the connection of venter and dorsum dark; setæ yellowish, their joinings dark; two dark dots each side on the upper plura. Tibia I dark at ends, femur reddish; basal joint of antennæ dark.

Fore wings hyaline, with a reddish tint along front, deepest in submarginal area and in the pterostigmatic area; cross-veins dark, longitudinal veins pale yellowish; hind wings with the cross-venation also dark; no spots on the wings. In several specimens the intercalary in front of the first anal is united to the anal near base.

The subimago has cloudy wings with dark cross-veins, in some specimens a black dot in the base of the median fork.

Expanse, 22 mm.

From Chapra, Bengal, India, February.

Abdominal marks are similar to those of *E. remensa* Eaton, but there is no trace of spots on the wings and the costal marks are different from that species.

Cloeon pulchella n. sp.

Female: Pale yellowish, abdomen rather darker. Wings hyaline, the costa faintly yellowish; about 25 cross-veins in the wings, and several of these are continuous across longitudinal veins, none near the margin, two or three in the pterostigma, widely separated, none before bulla; two intercalaries behind median, cubitus, and first anal, the posterior one of those behind median and cubitus is the longer.

Male: Thorax brown, basal segment of abdomen brown above, segments two

and three are pale, marked with brown, four and five white with brown hind margins, sixth white, with large brown spot each side behind, seventh broadly dark behind, eighth, ninth, and tenth wholly dark; venter hyaline, except last two segments dark. Fore femur dark at base, and a broad band at tip, and a dark line at tip of tibia.

Wings hyaline, a red-brown dot on inner end of great cross-vein, otherwise venation is hyaline, and on the same plan as that of the female.

Expanse, 8 mm.

From Chapra, Bengal, India. (Mackenzie).

HEMEROBIID.Æ.

Climacia basalis n. sp.

Body yellowish, head shining, antennae with two basal joints pale, rest black; thorax, legs, and abdomen pale. Wings pale, in base of fore-wing is an elongate curved, dark brown streak extending along radial sector from its origin out to first fork and then up on the upper branch for a short distance; stigma yellowish; gradates dark brown, almost bordered, the basal venation pale, beyond middle veins are dotted with brown, a faint brown cloud along basal anal margin; hind wings with brownish yellow venation, cross-veins darker. In fore wings about eleven costals before stigma, upper branch of radial sector connected three (or two) times to radius, first near base (sometimes lacking) second plainly before the stigma, and again under stigma; upper cubitus ends in five or six branches; the stigma of hind wing plainly swollen out.

Expanse, 8 mm.

From Bartica, British Guiana, December (Parish).

Climacia bimaculata n. sp.

Yellowish; a large black interantennal mark reaching above and below, head shining, three basal joints of antennae pale, rest black; thorax, abdomen and legs pale. Wings yellowish, venation yellow, outer gradates brownish, not very dark; each fore-wing with two large dark brown spots; basal transverse one over first fork of the radial sector and extending narrowly behind, second spot on costal and sub-costal area just before the stigma; stigma yellowish. Hind wings less yellowish, venation pale, a faint brown spot just before stigma. Fore-wings with about ten costal cross-veins before stigma, upper branch of radial sector connected three times to the radius, once near base, once at base of stigma, and under stigma, lower cubitus ends in four or five branches. Ovipositor long, slender, ends in a curved point.

Expanse, 8 mm.

From Bartica, British Guiana, December (Parish).

CHRYSOPIDÆ.

Chrysopa parishi n. sp.

Yellowish; a red mark under each eye, not reaching to mouth, a red mark back of each eye on the vertex and continued back on the anterior part (only) of the pronotum. Wings with very broad costal area, apex hardly acute, gradates black and margined, six in inner series, eight in outer row, inner series irregular, but nearer to radial sector than to the outer series, the marginal forks three times as long as broad, all veins rather stout, many faintly obscured, costals black at ends or almost wholly black, about 20 before stigma, three or four beyond end of the subcosta, radial cross-veins dark at upper end, divisory veinlet ends much beyond the cross-veins, second cubital cell as long as third, base of third oblique; pronotum but little longer than broad, narrowed in front.

Expanse, 29 mm.

From Bartica, British Guiana, December (Parish).

Chrysopa albatala n. sp.

Runs to *C. atala* Br. in Navas table, and very near to it, but differs at once in lacking a dark mark on cheeks and the palpi are marked with black. Antennae pale, basal joint with a dark line on outside; pronotum as broad as long, barely broader behind. Wings rather short, hardly acute at tips, with but few veins, about sixteen costals before stigma, four cross-veins behind stigma; gradates with four inner series and six in outer series, inner series nearer to the outer than to the radial sector; marginal forks about twice as long as broad; divisory vein ends at or a little beyond the cross-vein; third cubital equal to second, latter narrowed at tip and the third at base, more than usual.

Expanse 21 to 23 mm.

From Bartica, British Guiana, December (Parish).

Leucochrysa nigrovaria Walker.

Pale yellowish, a broad dark brown band under base of antennae from eye to eye, the lobe of vertex with a curved dark line in front; palpi unmarked; antennæ pale, first joint with an oblique, rather broad dark brown stripe above, second joint dark brown, next four or five joints infuscated within; margin of pronotum narrowly dark, a black spot on each lateral lobe of the mesothorax, and another near base of the fore wing, metathorax with dark spot above base of hind wings, third and fifth abdominal segments marked with black. Prothorax narrowed in front, a little broader than long. Wings with green venation; origin of radial sector, base of the divisory veinlet, outer gradates, ends of radial cross-veins and a few others dark; in hind wings venation almost wholly green. Stigma in both pairs dark in base. Seven or eight gradates in each series, inner series not nearer outer than to radial sector; marginal forks three times as long as broad; 21 costals before stigma in the fore wing.

Expanse 35 mm.

From Minero, Muzo, Colombia, 500 m. (Fassl.).

Chrysopa bolivari n. sp.

Similar to *C. caucana*. Antennae black, basal joints dull reddish, two dark spots on vertex, a black line from eye to mouth, and palpi marked with black; pronotum with two dark lines each side, one marginal, marginal dark stripe above base of wings on meso- and metathorax, and abdominal segment marked with dark on sides. Wings short, rounded at tip, few-veined, about fourteen costals, four cross-veins behind stigma, three or four gradates in each series, outer as near to inner series as to the margin, marginal forks not twice as long as broad, divisory ends beyond cross vein, second cubital as long as third, but not as wide. In basal part of wing several veins are thickened for a short distance, the radial sector between the first and second cross-veins to the median, the base of divisory cell, extending back on upper part of of second cubital cell, and also the cubital near base; these sections are about three times as broad as the rest of the vein, and furnished with minute spicules; these only in the fore-wing.

Expanse, 20 mm.

From San Antonio, Colombia, January, 2000 m. (Fassl.).

Chrysopa latithorax n. sp.

Greenish; a large, broad-bodied species; no dark marks except red line between antennæ; a whitish median stripe on thorax and abdomen, abdomen not dark on sides. Antennæ rather short and stout; prothorax fully twice as broad as long, much broader behind than in front. Wings rather slender, almost acute, rather densely veined, many costals, 9 to 11 gradates in each series, outer nearer to margin than to inner series; divisory veinlet ends at or barely before the cross-vein; third cubital shorter, but wider than second, its base very oblique; marginal forks about four times as long as broad; about eight cross-veins behind stigma, and three or four beyond end of the subcosta; radial sector dark at origin and out for some distance; most of the cross-veins dark, at least in part, and marginal forkings dark; in all wings there is one or more accessory gradate veinlets.

Expanse, 32 mm.

From Mendoza, Argentine, (Haarup).

Chrysopa confraterna n. sp.

Runs to *C. nobregana* in Navas table, differs by having a dark brown mark under each eye, but not reaching to mouth. Pale yellowish, probably greenish alive; head rather long and narrow; palpi with dark tips; vertex slightly tumid; pronotum broader than long, scarcely broader behind, with a faint mark each side.

Wings moderately slender, not acute at tips, with green venation, slightly darkened on costal and radial cross-veins, and on some other veins; gradates dark, inner of seven, outer of eight veinlets, outer series nearer to margin

than to the inner series; stigma green; divisory ends beyond the cross-vein; third cubital rather longer than the second, and widened at tip; marginal forks hardly twice as long as broad.

Expanse, 22 mm.

From Chacra di Coris, Argentine, 26 February, 20 March.

MYRMELEONIDÆ.

Acanthaclisis subfasciatus n. sp.

Face below antennæ wholly pale yellowish, basal joint of antennæ also pale, a black mark between antennæ, above is a transverse pale band, the vertex dull blackish, with three black joints or a line, all with short white hair; palpi pale. Pronotum yellowish, a median stripe (broader and divided in front), a narrow stripe each side not reaching behind, and the sides (broadly behind), all black; thorax brownish, a black stripe each side above wings; abdomen dull black, with short white hair; thorax with long white hair, and shorter erect black bristles; femora mostly blackish, tibiæ yellowish, the front and middle ones black banded on outside, hind tibiæ with black tip; tarsi black, pale on first and base of fifth joints. Wings hyaline; with about four faint brown bands before stigma, the first one extending over fork of cubitus, these bands are most distinct on radius and cubitus; between the bands the wing is hyaline whitish and most of the venation also; a dark mark at stigma and a spot at union of cubitus and median, and spots all around outer edge, a faint mark at end of anal vein; the subcosta has short dark spots, and the radius long dark spaces, many cross-veins are black, and the line of bent veins also black. In hind-wings is a mark at stigma, and faint clouds along outer posterior margin and a faint mark over cubital fork. Wings moderately slender, about as in *A. conspurcatus*. In fore-wings about seventeen to twenty-four costals are simple, and about as many crossed; in hind-wings no costals crossed; in fore-wing seven cross-veins before radial sector, in hind-wings four such cross-veins, twelve branches to radial sector in each wing.

Expanse, 80 mm.

From Kuranda, Cairns, Queensland, Australia. (Dodd).

All the other described Australian species of this genus have the costals crossed to near base of wing, only six or eight being simple.

The *A. fulva* Petersen resembles a species in British Museum (and my collection) which bears a manuscript name of van der Weele's. This species however has narrow wings, all veins (or nearly all) are red-brown, the mesoscutellum has two yellow dots, and hind wings have a cloud along outer hind margin. It comes from West Australia. I would name it but the type should be in the British Museum.

Acanthaclisis subtendens Walk. appears to be a small specimen of *A. fundatus*, at least the venation is about the same.

Formicaleon brahmanicus n. sp.

Head pale yellowish, a dark line under each antenna, and a spot above each, a bicurved line across in front of the vertex and a T-shaped mark on each side, and two little spots behind; antennae brownish, annulate with darker brown, palpi pale; pronotum pale, but not clear, a dark stripe along each outer margin from the transverse groove backward, and within is another lateral stripe each side slightly approximating behind; thorax pale, with many dark marks, one round each corner of the middle lobe, large geminate spot above each fore-wing, a streak reaching backward, leaving a very broad pale median area; pleura pale; abdomen pale, with a brown stripe each side, twice indented from above on each segment, segments three and four with a median and an apical spot (latter may be united to the side-stripes), fifth and following segments with the side-stripe broad and connected broadly at tip of segments; last few segments of venter dark; legs pale yellowish, with some black dots at base of the black bristles; mid and apical dark bands on tibiae I and II, tips of tarsal joints one to four black and a preapical band on last joint, this joint being nearly as long as all others together; spurs not much curved and as long as four segments, legs not very slender, femora thickened. Wings hyaline, longitudinal veins interrupted with dark spots, very faint on median vein, cross-veins often dark at ends; stigma very faint, a dark dot on the radius below stigma and one out near tip of wing, a spot between median and cubitus near their ends and one on cubital fork near margin; hind wings with many forks and veins in outer posterior part of wing embrowned, so as to form a dark streak subparallel to the outer fourth of the hind margin. Hind-wings longer than forewings, and a little more slender and very acute at tip, fore-wings also slender, and with acute tips, seven cross-veins in fore-wings before radius, eleven or twelve branches of radial sector, in fore-wings seven cross-veins between a cubital fork and anal, in hind-wing anal ends only a little beyond cubital fork, in fore-wings the vein up from end of anal soon runs back to the margin.

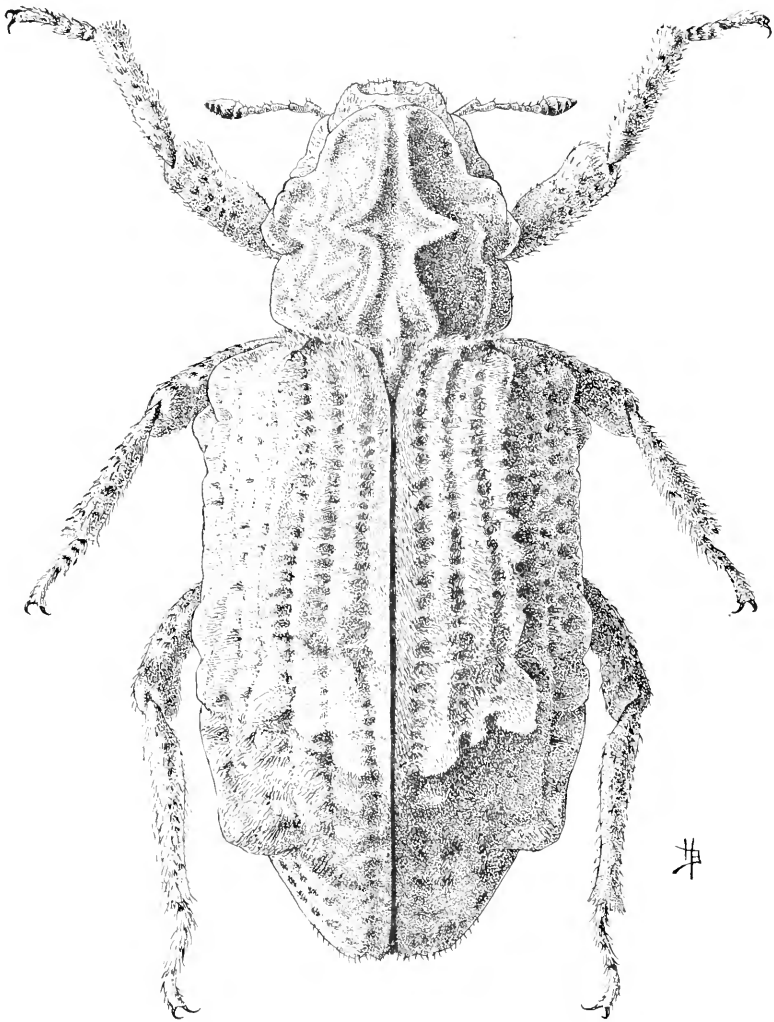
Expanse, 86 mm.

From Pusa, Bengal, 3 to 11 March, 17 June.

TRICHOPTERA.

Dinarthrodes niger n. sp.

Black, with rather reddish brown hair, legs brownish; antennæ with tips and base on outer side of joints white, leaving a triangular black portion on each joint; maxillary palpi erect, densely haired, the broad joint masking the face; basal joint of male antenna fully twice as long as vertex, very large, slightly concave beneath, above with two large erect processes; the basal one not as high as the other, concave within and from upper inner angle is a long slender process reaching over to the opposite antenna; second process rather beyond the middle, subconical. Legs slender, not densely haired, spurs, 2, 4–4. Fore-wings rather slender, apex roundedly truncate, forks



Rhigopsidius tucumanus HELLER, DORSAL VIEW, GREATLY ENLARGED.

1, 2, and 5, discal cell nearly as long as pedicel. Ventral male appendage long, upcurved, with a slender apical piece, pale and bare.

Expanse, 19 mm.

From Batavia, Java.

PRELIMINARY REPORT OF THE FINDING OF A NEW WEEVIL ENEMY OF THE POTATO TUBER.

By E. R. Sasscer and W. Dwight Pierce, *Bureau of Entomology.*

On May 21 of the current year, a number of potato tubers (*Solanum tuberosum*) from the neighborhood of Huarochiri, Peru, were received by Mr. F. V. Coville and were inspected by one of the authors (E. R. S.) and Mr. H. L. Sanford in accordance with the regulations governing importation of nursery stock by the United States Department of Agriculture. This examination revealed the presence of weevil mines and also those of the potato-tuber moth (*Phthorimæa operculella* Zell.?).[1]

Material infested with larvae, pupae and adults, and collected by Mr. W. F. Wight for horticultural purposes was received from the following localities on May 24: Cuzco, Temuco, and Arequipa, Peru; Oruro, Bolivia; and Ancud or San Carlos and Castro Islands, Chili. In many instances injury occasioned by these weevils was quite noticeable. But a few of the tubers which superficially appeared to be sound, on being opened, were found to be infested with one, and sometimes two, larvae or adults.

Two adults were kept alive from May 24 to September 6. During this period they fed but little and then only on foliage of potato.

This species has been determined by one of the authors (W. D. P.) as *Rhigopsidius tucumanus* Heller,[2] a species originally described from Tucuman, Argentine. It belongs to the subfamily of weevils known as *Rhytirhininæ*, tribe *Rhytirhinini*. The nearest North American insects are the species of the genus *Thecesternus* in the tribe *Thecesternini* of the same subfamily. Nothing whatever is known of the habits of this latter tribe, and the habits of only one species in the *Rhytirhinini* have been indicated.

The specimens at hand may be described briefly as follows:

Length 9 mm., yellowish or purplish brown, with thickly matted vestiture of a cinerous shade mottled with black dots. Head concealed from above by prothorax and eyes, almost covered by the lateral prothoracic lobes. Beak moderately short, usually reposing in a deep pocket of the

[1] Determined by Mr. August Busck.

[2] Stett. Ent. Zeit., 1906, vol. 67, pp. 7–9, pl. I figs. 3, 3a, 3b.

prothorax, which is posteriorly limited by the anterior coxae. Beak medianly and laterally carinate to a cross between the bases of the antennal scapes. Scrobes deep and narrow from apex near tip of beak almost to eyes, then sharply deflected and broader in front of eyes. Scape stout, clavate. Funicle 7-jointed, the last joint apparently a part of the club. Club 4-jointed. Head at base of beak sinuately impressed, with swellings above the eyes. Prothorax very irregularly sculptured but with a deep median furrow widened angularly at middle and also behind. Strial punctation deep but irregular. Intervals tumid behind. Legs stout. Tarsi with third joint not widely bilobed; tarsal claws simple. First and second abdominal segments long; third and fourth shorter than fifth.

A NEW BRACONID FROM SOUTH AMERICA.

By S. A. Rohwer, *Bureau of Entomology.*

Monogonogastra wolcottii, new species.

In Szepligetti's arrangement this species falls next to *meridensis*. The following description will show how different it is. In Cameron's list of species it falls next to *Iphiaulax hector* Cameron, but is at once separated from that species by the suture-formed articulations being striate. It resembles Cameron's species, however, in general habitus and color.

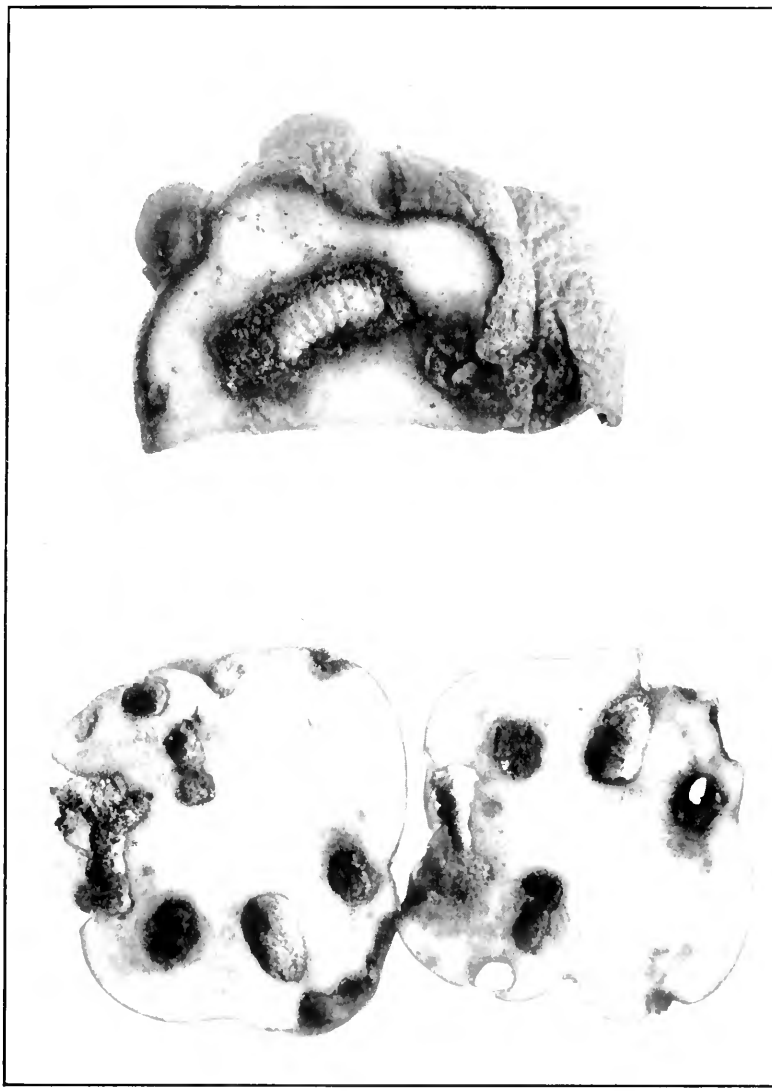
Female.—Length 14 mm., length of the ovipositor 12 mm. Antennae extending back beyond the apex of the third tergite; head shining, front depressed between the ocelli and the antennae; a strong carina from the anterior ocellus to the bases of the antennae; ocelli surrounded by a deep furrow, posteriorly bottom of the furrow is granular; postocellar line distinctly shorter than the ocellocular line; thorax shining, the scutellum raised slightly above the level of the scutum; first tergite with the embossed area broadening apically into a rounded spade-like area the apex of which is obtusely rounded; embossed area of the second tergite tiangular, not reaching apex, defined laterally by shallow, broad, foveolate furrows; suture-formed articulations foveolate; tergites shining, polished; apical sternite extending more than the width of the femora beyond the apex of the abdomen. Rufo-ferruginous; head except the palpi, antennae and sheath of the ovipositor black; posterior tarsi dusky; wings yellowish hyaline basad of the basal vein, beyond dark brown, a transverse yellow band beneath the stigma; venation dark brown; stigma bright yellow.

Golden Fleece, Demerara, South America. Described from one female collected March 13, 1913, by G. E. Bodkin and G. N. Wolcott.

Named for G. N. Wolcott.

Type: Cat. No. 16020 U. S. N. M.

Actual date of issue October 2, 1913.



ABOVE. SECTION OF POTATO FROM PERU, SHOWING LARVAE OF *Rhigopsidius tucumanus* IN ITS BURROW.

BELOW. SECTIONED POTATO SHOWING BURROWINGS OF *Rhigopsidius*.

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PROCEEDINGS

OF THE

ENTOMOLOGICAL SOCIETY

OF WASHINGTON

VOL. XV 1913 No. 4

MEETING OF JUNE 5, 1913.

The 269th regular meeting of the Society was entertained by the Executive Committee in the Saengerbund Hall, 314 C street N.W., on the evening of June 5, 1913. There were present Messrs. Baker, Barber, Boeving, Busck, Cushman, Duckett, Ely, Fisher, Gill, Greene, Heinrich, Kirk, Knab, Pierce, Quaintance, Rohwer, Sanford, Sasser, Schwarz, Shannon, Turner, and Wood, members, and Messrs. W. S. Abbott, Jacob Kotinsky, and Dr. William H. Fox, visitors. President Busck occupied the chair.

Mr. Rohwer stated that he had received a letter from Dr. Sharp who was recently elected Honorary Member stating that he was sending for the use of the society a copy of Fauna Hawaiiensis. The publication is to be filed in the Division of Insects Library at the National Museum.

The following papers were presented.

NOTES ON THE LIFE HISTORY OF RHOPALOSOMA POEYI CRESSON.

BY J. DOUGLAS HOOD, *Biological Survey.*

While collecting on Plummer's Island, Maryland, the sixth day of last October, an adult female of the jumping tree cricket, *Orocharis saltator* Uhler, was seen scampering over the forest floor as rapidly as a large abdominal protuberance and a nearly functionless hind leg would permit. It was placed in a pill box and later transferred to a suitable rearing cage for observation.

The protuberance proved to be an external parasite, the larva of *Rhopalosoma poeyi* Cresson. It was attached at the third ab-

dominal segment of the cricket to the membrane between notum and pleuron, and lay along the right side of the abdomen; the posterior end at time of capture was about opposite the metathorax, and the anterior end at the eighth abdominal segment. The sac was reniform, leathery in texture, brownish gray in color (slightly darker than the cricket itself), and nearly circular in cross-section. Its size and place of attachment thus forced the hind leg downward and far out of its normal position; but, aside from the loss of the use of this member of its body, the cricket appeared to be but little inconvenienced.

During the next few days the parasite increased rapidly in bulk until, on the morning of the ninth, three days after capture, it was about equal in size to the abdomen of its host, measuring just 7 mm. in length and 3.5 mm. in diameter. At 1 p.m., the integument was seen to have split in front along the median dorsal line,

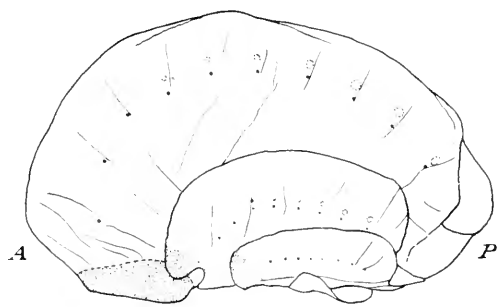


Fig. 1. Exuviae of *Rhopalosoma poeyi* Cr. *A*, anterior; *P*, posterior.

and through the split projected the head of the larva. By 2 p.m. three body segments were exposed above, the larva furthering this process by movements of the body. The cricket remained nearly motionless, only occasionally vibrating its palpi. At 4.30 p.m. there seemed to be no change, and further observations could not be made until the next morning. Then the cricket was dead; the sac was split along the dorsum from end to end; and the parasite itself was beneath the soil. Here it remained until some time in December when, at the suggestion of Mr. H. S. Barber, it was removed and placed in a plaster cell. According to Barber, the adult emerged indoors about March 1.

The several exuviæ (fig. 1) which remained attached to the cricket after the penultimate ecdysis indicate at least five larval instars, inclusive of the one passed underground. Towards the point of attachment the surface is smooth and shining, becoming granulate

externally. Each larval skin shows about ten spiracular openings, and above the posterior six or seven are nearly circular membranous areas. Anteriorly the exuviæ are thickened, darker in color and more shining, as indicated by the stippled areas in the figure.

——Mr. Rohwer commented on Mr. Hood's paper as follows: Mr. Hood is to be congratulated for bringing before science these interesting notes on one of the most remarkable Hymenopterous insects known. *Rhopalosoma* Cresson is a genus which is very difficult to place and many of the most able Hymenopterists have expressed their views as to its systematic position. To give some idea of the difficulty in placing this genus the following summary of locations it has occupied is given: Cresson described it as an anomalous Braconid; Haliday considered it as a Sphecid related in some extent to *Sceliphron*; Westwood originally considered it related to the Vespidæ, but later considered it as a fossorial Hymenopteron; Smith at first placed it among the ants, but on closer examination placed it in the parasitic Hymenoptera; Ashmead, before this Society, in 1896, summed up the characters of this remarkable genus and ended by making a new family for it, which he placed in his heterogeneous superfamily Vespoidea; Morley 1910, states that it can be "placed nowhere among the Parasitica or Terebrant Hymenoptera," and adds that no matter where it is placed it will form an aberrant group. The author of these remarks believes that Ashmead was more nearly correct than any of the other authors, but is of the opinion that the Ashmedian superfamily Vespoidea could be well divided into a number of smaller and more natural superfamilies (and such has already been suggested by Mr. Banks when he proposed the superfamily Scolioidea) and that *Rhopalosoma* and the allied genus *Paniscomima* should form one of these superfamilies.

Heretofore the habits of the immature stages of this curious genus have remained unknown, and now that they have been outlined it is hoped that more study will be made of them, as it is very likely that they will throw some light on the systematic position of this interesting group. Even now one is confronted with the remarkable resemblance between the larva of *Rhopalosoma* and some of the Dryinids (for habits of the Dryinidæ see R. C. L.

Perkins, Bul. 1, pt. 1, Exp. Sta. Hawaiian Sugar Planters' Association). Perhaps the Rhopalosomidæ and the Dryinidæ had a common origin, as the larvæ would indicate, and the adults have specialized along different lines though retaining certain characters in common.

It may be interesting to add that the family Rhopalosomidæ is now represented by four species, one of which has been placed in a genus of doubtful standing. Three species have been reported only from the Neotropical region, and one which is known to occur in India and Ceylon from the Oriental region. The *Rhopalosoma poeyi* Cresson was originally described from Cuba but since has been reported from Jamaica; San Domingo; Hayti; St. Louis, Missouri; North Carolina; St. Augustine, Florida; Louisville, Kentucky; and now from the environs of Washington, D. C. Lest some marvel at this remarkable distribution it may be added that great care was used in making the determination of Mr. Hood's specimen and unless there are characters which have escaped both Ashmead and myself this species has the wide distribution given above. An excellent figure of this species is given on plate 24 (figure 9) of Thesaurus Entom. Oxon. 1874.

NOTES ON THE FEEDING HABITS OF TWO ADULT SAWFLIES.

By S. A. Rohwer, *Bureau of Entomology.*

The feeding habits of adult sawflies are very incompletely known, although a few European species have been observed feeding either on the pollen of plants or on certain insects. From the literature which has been published on this subject it is a rather accepted opinion that the species of *Tenthredella* and *Tenthredo* feed, in the adult stage, on other insects. The following observations will show that this is not always the case. As far as I have been able to learn the records refer to feeding habits of the female only. Do the males feed?

TENTHREDELLA LINEATA (Provancher).

On July 4, 1907, I found a female of the species devouring an adult Perlid which has been determined by Mr. Banks as *Alloperla signata* Banks. The adult sawfly was sitting on the foliage of *Heracleum lanatum.*

TENTHREDO ARCUATUS (Foerster).

On August 8, 1909, at Sonnenberg, Lucerne, Switzerland, I had the opportunity to make the following observations on the feeding habits of an adult which belonged to this species. This adult had only one antenna, but as far as could be observed behaved in a perfectly normal manner, and was so docile that it could be observed under a half inch lens. This female would fall, alighting heavily on the head of one of the common Umbellifers and, due to the momentum of the flight, would fall beneath the head of the Umbellifer. After recovering itself and righting itself on the flower, it would bite a stamen off near its base and fall beneath the crown of flowers holding itself downward by the four posterior legs. In this position it proceeded to devour an entire stamen, using the maxillary palpi, mandibles and labrum, but the labial palpi did not move. After the entire stamen had been devoured the sawfly would repeat the operation until it had completely devoured four stamens. After devouring four stamens it walked over the head of the flower and by use of the palpi obtained the small drops of liquid adhering to the base of the receptacle. After visiting all the flowers on the head, the insect took flight. To make sure of the species it was captured before it had the opportunity to alight on another flower. The species of Umbellifer was not determined.

In commenting on this species in the Entomologist for February, 1913, Morley states that he has seen it chase flies and has known of one female found masticating a female *Empria pennipes*.

TWO ABNORMALLY DEVELOPED SAWFLIES.

By S. A. Rohwer, *Bureau of Entomology*.

Although the sawflies often have abnormal venation, it is very seldom that a sawfly with abnormal body characters is ever collected. As far as I am able to learn only seven gynandromorphic sawflies have been reported upon. In view of the fact of the usual stability in the bodies of sawflies the following notes may be interesting.

XENAPATES TERMINALIS (Say).

On May 13, 1911, along with other sawflies collected at East Falls Church, Virginia, an abnormal female of this species was collected. The abnormality occurs in the abdomen which does not have the gonapophyses developed except slightly, and the nates are abnormal. The cerci are normal as is the rest of the insect. The abnormal development of the eighth ventral and the entire

ninth abdominal segments while the rest of the insect developed normally, is not without interest. This abnormality is readily noted as the sheath (which is composed of the gonapophyses, which are appendages of the eighth and ninth ventral segments) is so reduced that it cannot be seen without magnification of thirty-five diameters.

TENTHREDELLA SPECIES (PROBABLY VERTICALIS Say) MALE.

At Glencarlyn, Virginia, on June 9, 1911, a male of this species was collected, in which the lateral ocelli are entirely wanting. This causes the vertex to be depressed. Along with this abnormality of the head goes a slightly different type of coloration and a narrowing of the facial quadrangle, so it is impossible to accurately determine this male. The obliteration of the ocelli is the first record of the kind known to me.

In this connection, for completeness' sake, it may be well to call attention to the abnormally developed propodium in *Oryssus abietes* Rohwer, which is described on page 154, Proc. U. S. Nat. Mus., vol. 43, September, 1912.

NOTE ON A BARKMINING LEPIDOPTERON OF THE GENUS MARMARA CLEMENS.

By August Busck, *Bureau of Entomology.*

In the course of the work on forest Lepidoptera at Falls Church, Virginia, we have lately bred several specimens of *Marmara fulgidella* Clemens, from oak; it is gratifying to find that the biology of the species definitely confirms the generic determination made by Mr. Chas. Ely and myself a year ago, when we transferred the species from the genus Gracilaria to Marmara, solely on pterogostic characters.

The larva is of the identical flat, deeply segmented form as that of *Marmara salictella* Clms., the type of the genus. It forms long winding galleries just under the epidermis of young trunks and branches of oak, similar to those of *M. salictella* Clms. on willow, and leaves the mine in early spring, April, to spin a small cocoon in some convenient crack in the bark. The cocoon is ornamented by similar globular air-bubbles, voided by the larva through the anal opening as is characteristic of the other species of this genus. Imago issued in May.

Similar *Marmara* mines were found less commonly on chestnut, but unfortunately the imago were not secured this year; this may prove the same species or one of the allied forms, *fasciella* Chmb., or *elotella* Busck, as yet listed under the genus *Gracilaria*.

——Mr. Busck also presented a recent work by Dr. C. Wesenberg Lund of Denmark,[1] which he strongly commended to the members' attention as an excellent biological study. Mr. Busck referred in detail to some of the subjects in the article and passed around the interesting plates of the egg-laying habits of this group of insects.

NOTES ON A WOOD-BORING SYRPHID.

By H. S. Barber, *Bureau of Entomology.*

A hickory log in early stages of decay, which was found in the vicinity of Washington, had lost its bark, and the weather beaten surface of the wood showed numerous holes, with caked damp sawdust that had been thrust out. This work was mistaken for the borings of the larvæ of the Lymexylonid, *Melitomma sericeum Harris*, but when chopped into, the log disclosed numerous short cylindrical grubs of a form that the speaker had never seen before. These were shown to numerous entomological friends, but no one could place them with any certainty. Specimens were caged for breeding and the log was frequently examined for changes in the larvæ. At last a pupa was found and this latter disclosed a Syrphid fly (*Temnostoma bombylans*) the larva of which appears to have been previously unknown. Before this was bred, however, larvæ were shown to Mr. A. B. Champlain, who on his return to Harrisburg, Pennsylvania, found similar larvæ boring abundantly in very soft rotten willow wood. He also bred the flies, and has forwarded his material to Mr. W. R. Walton. Dr. Boeving and Mr. Shannon also found similar larvæ on the Virginia shore opposite Washington. Comparison of the larvæ, however, shows great differences in the armature of the spiracles. From this it becomes evident that more than one species is involved in the colonies. Adults bred from these different colonies corroborate this idea, and are more or less different, so that it appears to the speaker that about four species are involved in America under the name *Temnostoma bombylans*. This name was originally applied to a European form. There are, however, a number of names available for American forms that have been sunk as synonyms of *bombylans*, but it is not known to what forms these refer.

In the first log found, the wood was very hard and brittle but showed signs of ferment, and contained much moisture. The galleries were cylindrical, clean-bored holes, and all boring dust was extruded at the surface of the log. Under these conditions the larvæ need strong protection against predatory enemies. This is

[1] Biologishe Studien über Dytisciden (Footnote: Published in Internationale Revue der Gesamten Hydrobiologie und Hydrographie, Leipzig, 1912.)

supplied in the extremely hard chitinization of the anal segment, and furthermore by the development of spiny processes around the elevated spiracles. To determine the utility of this apparatus, a specimen was placed in a glass tube the size of its original burrow, and from time to time disturbed by thrusting a bristle down the tube beside it. Immediately upon being touched this horny armature was thrown violently against the side of the tube pinching the bristle firmly. The fate of any Clerid or other predatory larva that should attempt to reach the soft forward part of its intended victim, can only be surmised, but this defensive organ appears perfectly effective. In two beetle larvæ a peculiar anal armature has been observed which appears to be more or less effective in the same manner, the first simply for defense, the second both defensive and offensive. The first is *Melitomma* (*Lymexylon*) *sericeum* in which the anal segment is very heavily chitinized, obliquely truncate, and strongly concave, the margin furnished with short stout teeth. This can be used to completely plug the gallery against an intruder, and by crawling backward to slowly force it out of the gallery. The other species is *Hylocœtus lugubris* a member of the same family, in which the first stage larva has an anal segment very similar to the last mentioned species, but which in later stages develops into a long horny process armed on the dorsal side with sharp teeth. These, it is believed, would be fatal to any soft bodied enemy that should try to crawl past. The syrphid larvæ from the softer, more decayed logs however, were of a different type of anal armature in which only the spiracle prominence is chitinized. These also do not seem to make definite galleries, and are equally available to their enemies from all sides. As before stated they are believed to be a distinct species. A single specimen of *T. æqualis* was bred by Mr. Champlain amongst many *T. bombylans* so-called.

At first sight the larvæ of *Temnostoma* appear to be furnished with powerful out-turned mandibles comparable to those in the larvæ of the Enenemidæ, and certain Hymenoptera, but these are probably only plates of the head that have become functional for boring, the real mandibles being internal within the mouth, which is well on the under side of the head. The speaker exhibited photographs and sketches of the specimens and their work.

Meeting of October 2, 1913.

The 270th meeting of the Entomological Society of Washington was entertained by Mr. E. A. Schwarz in the Sangerbund Hall. There were present Messrs. Baker, Banks, Barber, Boeving,

Busck, Cory, Craighead, Cushman, Duckett, Ely, Gahan, Greene, Heinrich, Hopkins, Howard, Kirk, Knab, McAtee, Middleton, Mc-Indoo, Quaintance, Sanford, Schwarz, Shannon, Snyder, Walton, and Wood, members, and Messrs. Frederick Karl, Chas. Menagh and Drs. W. A. Hooker and Martini, visitors. Mr. Schwarz reported that the next number of the Proceedings had been printed and would be mailed to the members in a few days. The name of Dr. Martini was proposed by President Busck for corresponding membership and that of Mr. W. S. Abbott by Mr. Cushman for active membership.

Mr. Busck remarked on the difficulty experienced by the Secretary in securing notes given at the meetings. He also read a letter from Mr. Caudell, addressed from Copenhagen.

The following papers were presented.

BIOLOGICAL NOTES ON A FEW RARE OR LITTLE KNOWN PARASITIC HYMENOPTERA.

By R. A. Cushman, *Bureau of Entomology.*

The observations brought together here are presented with the consent and partly at the suggestion of Dr. L. O. Howard, Chief of the Bureau of Entomology.

PERILITUS AMERICANUS Riley.

This Braconid parasite of lady-beetles was very abundant in the region of Vienna, Virginia, during the fall of 1912, invariably, so far as the observations of the writer go, parasitic on *Megilla maculata*. This coccinelid, following its habit of congregating in large numbers in the fall in some protected place, used as shelter the burlap bands put around apple trees for trapping codling moth larvæ. Large numbers of these were parasitized by *Perilitus*. During the past spring the abundance of *Perilitus* was again noted, many lady-beetles astride of the parasite cocoons having been taken from low herbage, especially clover infested by *Macrosiphum pisi*. Although a number of other species of Coccinellidæ, encouraged by the unusual abundance of aphids, were fully as abundant as *Megilla*, none but the latter and a single specimen of *Hippodamia convergens* were found to have been parasitized.

Adult specimens of the parasite reared in the fall of 1912 when placed with various species of coccinellids attacked the different species apparently indiscriminately but no progeny resulted.

The first adult *Perilitus* secured in the spring of 1913 was reared May 5 from a *Megilla maculata*. This was fed on diluted honey and placed in a large vial. She was then given access to various species of coccinellids including *Adalia bipunctata, Anatis* 15-*punctata, Hippodamia glacialis, Coccinella* 9-*notata, Hippodamia convergens, Megilla maculata, Cycloneda sanguinea* (=*munda*), and *Hyperaspis* sp., as well as a number of undetermined larvæ. All of the species including the larvæ were observed to be attacked except *Hyperaspis* sp. The larvæ were apparently attacked at any point, while the adults seemed to be attacked only between the segments, usually those of the abdomen, although the sutures between the head and thorax and thorax and abdomen were not neglected.

In oviposition the parasite assumes a position exactly similar to that taken by *Aphidius*, facing the prospective host and thrusting the ovipositor forward beneath the body and between the legs. The parasite perceived the presence of the beetles from a distance of at least 1 inch, when she would show great excitement by rapid vibration of the antennæ and quick movement toward the beetle. Having approached within feeling distance she extended the ovipositor in readiness for the attack and began dancing about her prospective victim, advancing and retreating and finally, when a good opening offered, rushing in and giving a quick thrust. This was repeated with each beetle several times. Another female parasite reared May 14 was placed in the same vial and began its attack on the beetles immediately without taking food. At later dates other parasites were reared. All were females.

During the progress of the observations many beetles and larvæ were attacked. Of these only one, an adult *Megilla*, showed any further signs of parasitism. The parasite larva emerged from its host and spun its cocoon but did not mature.

The latest parasite to emerge in the spring appeared on June 14, having developed within the body of a *Hippodamia convergens*.

Some years ago there was published in Insect Life some discussion as to the point from which the *Perilitus* larva emerges from its host, the ventral sutures between the abdominal segments and that between the thorax and abdomen being suggested as possible points of egress. The actual emergence of the parasite from its host was apparently, however, never observed. On May 19,1913, it was my good fortune to find a *Megilla*, from which the parasite larva was just emerging. It was protruding from beneath the elytra of the host and had forced the tip of the abdomen downward. Very carefully I clipped the elytra and wings of the beetle to determine the exact point from which the parasite was coming. This point I found to be the suture between the fifth and sixth abdominal segments slightly to the right of the median dorsal line.

The parasite was apparently about one-third free. I hoped to determine the manner in which the parasite gets into its position beneath its host without losing its hold, and to this end carried the specimen in a vial in my pocket for the rest of the day examining it frequently. But unfortunately it seemed in some way to have been injured, probably when the elytra of the host were cut, and succeeded in getting no further. When the next morning it was still in the same position, I preserved host and parasite, after first

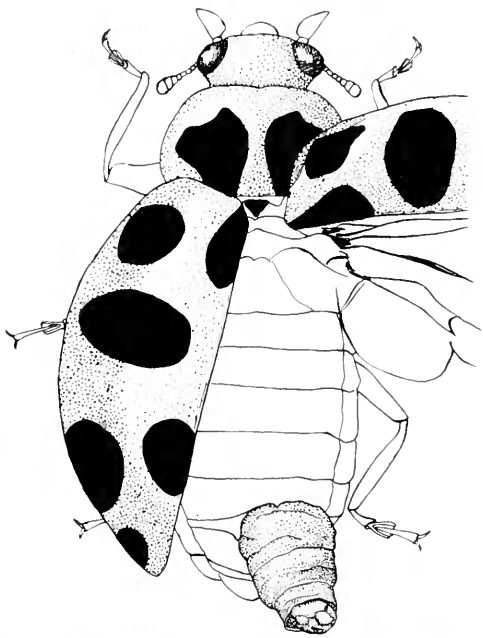


Fig. 1. *Perilitus americanus* Riley larva issuing from *Megilla maculata*.

sketching the specimen. The accompanying figure shows the relation of parasite to host (fig. 1).

All of the coccoons of *Perilitus* which were collected in the fall of 1912 produced adults during that season, and these adults readily attacked coccinellids. It seems probable, therefore, that the species hibernates as larvæ within the host.

PANISCUS GEMINATUS Say.

On August 22, 1912, under a band on an apple tree I found a Lepidopterous larva bearing just back of its head a pecular ex-

ternal parasite larva. It was evidently in the first stage, the head being dark and distinctly marked off from the rest of the body. It was semitransparent and of a pale greenish color. The peculiar thing about it, however, was the fact that its caudal end was inserted in a shining black, goblet-like receptacle, the base of which was firmly attached to the body of the caterpillar. The receptacle, or egg-shell as it turned out to be, is shown in figure 2a, the larva and egg-shell at figure 2b, and the larva in situ on its host at figure 2c. When found the parasite was about one-eighth of an inch long and rather slender. As development progressed it became stouter and the head less distinct until, at full growth, when it

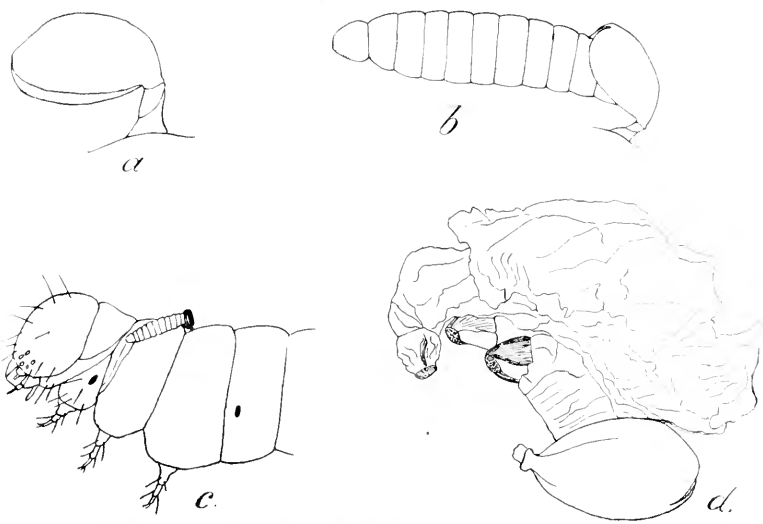


Fig. 2. Stages of *Paniscus geminatus* Say. *a*, egg shell; *b*, young larva attached to egg shell; *c*, young larva in situ on host; *d*, three larval skins attached to egg shell.

left its host and spun its cocoon, it was about one-half an inch long and a third as thick. During all this time it remained attached to its host by the egg-shell. Not until it left its host and spun its cocoon was it discovered that it had molted without releasing its hold on the egg-shell. Then it was found that there were attached to the shell three molted skins varying in size and texture with the age of the larva when they were discarded. The earliest molted skin was densest and the head shield quite heavily chitinized, the second somewhat less so, and the third very delicate and the head shield barely heavier than the body skin. This is shown in figure 2d.

Full growth was reached on September 10, thirty-two days after the specimen was found and by the morning of the 11th it had spun its cocoon. This was nearly black, about one-half inch long and almost cylindrical with rounded ends. In order to hasten the maturity of the parasite it was kept indoors during the winter, but the adult not appearing the cocoon was opened on March 10, and the parasite was found to have matured and died. That death had been quite recent was indicated by the fact that the parasite was not entirely dried. It is a female *Paniscus geminatus*.

POLYSPHINCTA TEXANA Cr.

On April 8, 1913,I found an adult female spider (*Steatoda borealis*)bearing an external parasite larva. The parasite was about three-sixteenths of an inch long and was curled transversely about the front end of the abdomen of the spider. The large size of the parasite together with the early date probably indicates that it had hibernated on or in its host. By the next day within a period of about seventeen hours the parasite had increased to nearly double its length when found and the contents of the abdomen of the spider had been entirely consumed. The larva was placed in a cell between two slips of transparent celluloid to make further observations on the development possible. On April 12 the parasite had started its cocoon but never finished it and died without pupating.

On April 10 another spider of the same species was found bearing a similar parasite larva. In this case the larva was not more than one-eighth of an inch long. By April 14 this parasite had consumed the liquid contents of the host and by April 16 had constructed its cocoon. This was slightly less than one-half inch long by about one-third as wide and somewhat more tapering toward the caudal end. It was loosely woven of pale yellowish, very curly silk. On April 25 the parasite pupated and on May 9 it transformed to the adult condition. This gives a period from the time of leaving the host to pupation of eleven days and a pupal period of fourteen days.

When, on May 12, the adult parasite had not left its cocoon and was inactive the cocoon was cut open and the dead parasite, a deformed female *Polysphincta*, removed.

SPHÆROPYX BICOLOR Cresson.

Apparently nothing concerning the host relations of this species has been published. Under my codling moth bands on apple and pear trees I have frequently taken it in immature stages as a parasite of *Apatela clarescens* Guen. The parasite is gregarious, as many as 30 having been reared from a single host.

On October 14, 1911, two caterpillars of *Apatela* were taken under bands and put in vials. One of these was healthy and pupated later. Concerning the other, which it later developed was parasitized by *Sphæropyx*, my notes are as follows: "The parasite larvæ emerged from the host this morning. They issued from various points along the back and sides of the host, appearing at first as whitish papillæ, and gradually forced themselves through openings of smaller diameter than their bodies. When first emerged they were about three-sixteenths of an inch long, but within a few hours they nearly doubled in size, simply engorging on the fluids of the host."

Another caterpillar taken with others on July 23, 1912, turned out to have been parasitized, when three days later on July 26, about twenty-five of the large pinkish larvæ of *Sphæropyx* were found to have issued from it. These had reached full size when the fact of parasitism was discovered. Seven were placed in cells between slips of transparent celluloid for observation on the further development. The cocoons had been spun by the next morning. On August 1 the following notes were made: "As the pupa develops within the larval skin the pink color becomes concentrated in the abdominal region, becoming especially evident as a red streak along the median line where there are no fat bodies to obscure the color. This morning, the insect being in what may be termed the prepupal condition, this coloring matter has been discharged as a wine colored liquid and the insects are opaque white. As the prepupal condition is assumed there is a considerable, gradual shortening of the body." On August 8 five of the parasites pupated. The other two died without pupating. By August 10 the pupæ had begun to assume the adult colors, the head and thorax having become black, and on August 12 the abdomen had become red. On August 13 three had transformed to the imago and on August 14 the other two had done likewise. The first three to transform emerged on August 15 and the others on August 16. That the development was not influenced by the method of handling was shown by the fact that adults were reared from other larvæ on the same host at the same time as from those in the transparent cells.

The development from the time the larvæ emerged from the host to the date of the issuance of the imagoes was as follows: from emergence to spinning of cocoon 1 day, from cocoon to pupation $6\frac{1}{2}$ days, pupal period $10\frac{1}{2}$ to $11\frac{1}{2}$ days, period from transformation to emergence 2 days, period in cocoon 19 to 20 days, and total period from emergence of larva from host to issuance of adult 20 to 21 days.

All of the specimens reared from the above lot were males. From a number of hosts only females were reared, but from a majority

of hosts the parasites of both sexes emerged, the males issuing from one to two days ahead of the females. The following table gives the proportion and distribution of the sexes so far as this was determined.

Table showing proportion of males an dfemales of Sphæropyx bicolor Cr. in specimens reared from individual hosts.

♀	♂	♀	♂	♀	♂	♀	♂
15	3	17	2	2	1	17	2
0	8	3	0	29	0	10	4
25	0	11	10	26	0	16	12
9	0	0	24	13	3	22	0
18	0	17	13	1	2	14	1
14	1	17	0				
				Total,		296	86

When the cocoons, which are of white silk, are spun under natural conditions within the host cocoon they are packed parallel in a close mass with their axes nearly perpendicular to that of the host cocoon. The parasite hibernates as a larva within its cocoon.

Very frequently *Sphæropyx bicolor* is attacked in its cocoon by *Dibrachys boucheanus* Ratz., an omnivorous secondary parasite, although it is but seldom that all the cocoons in a mass are parasitized.

Two cases of double primary parasitism in which this species took part were observed. The other species in each case was a tachinid fly. In the first case the tachinid eggs were found on the skin of a caterpillar, from which a few days later the larvæ of *Sphæropyx* emerged. In the other instance, an adult tachinid was reared followed three days later by nine females of *Sphæropyx*.

The discovery that certain members of the subfamily *Chelonina*, to which *Sphæropyx* belongs, parasitize the eggs of their host, their larvæ issuing later from the host larvæ, led to the conducting of experiments on a small scale to determine the oviposition habits of the species under discussion. Some eggs of two species of *Apatela*, one of which feeds on wild cherry and the other on pear, were secured and exposed to the attack of *S. bicolor*. It was noted that while the parasites took no notice of the eggs they showed great excitement when on leaves bearing eggs, running rapidly about dragging their ovipositors over the surface of the leaf and searching minutely with their antennæ. No such excitement was shown when uninfested leaves were supplied. This suggests that the search for hosts may possibly be guided somewhat

by the scent left by the parent moth on the leaves on which she oviposits. At about this time a larva of *A. clarescens* about one-third grown was found. This was placed in the cage with the parasites. They seemed to be interested only in avoiding it.

A few days later some of the *Apatela* eggs hatched. The newly hatched larvæ were exposed to the attack of the parasites and were almost immediately attacked, the parasites fairly pouncing upon them. During the act of oviposition the host larva is beneath the parasite, whose ovipositor is extended forward and inserted in the side of the host. Subsequently caterpillars of various sizes up to a third of an inch in length were exposed to the attack of the parasite, but in no case was any except newly hatched or very young caterpillars attacked. All larvæ that were attacked by the parasite were isolated and fed in order to obtain further data on the life history of the parasite. Most of them died while very young, while those that lived produced only moths, so that there is only negative proof that the attack observed in the cages is the natural one.

At one time during the progress of the experiments with *S. bicolor* a large number of living females were confined together in one cage, which was placed against the screen of the insectary. Several males of the species were captured on the outside of the insectary, having evidently been attracted by the scent of the females.

——In the discussion of Mr. Cushman's paper, Dr. Hopkins called attention to a reference in an early number of Insect Life (III, p. 20) to his observation on the parasite, *Perilitus*, of the adult of *Hippodamia maculata*, and the evidence found by him that the parasite larva emerged from the ventral part of the body, through the suture between the abdomen and metasternum.

Dr. Hopkins also mentioned, in this connection, the common occurrence of parasitized adults of Scolytid beetles, especially those of the genus *Ips*. The parasite (*Tomicobia tibialis* Ash. det. Ash.) oviposits through the elytral suture and the adult emerges through a round hole in the declivity. Dead or living adults are often found in the insect boxes, having emerged after the beetles were mounted on card points.

——Dr. Howard said that work of the character just described by Mr. Cushman was of very great value. This and similar work carried on by Mr. Timberlake, and which also related to the intimate life history of parasitic insects, has much potential prac-

tical value. We must know the full biology of parasites before we can handle them practically with any certainty. So much of this character is being done in the Bureau, and so little elsewhere, that it is important that any parasite introduced by a state Entomologist should be referred to the Bureau before liberation.

Dr. Howard, referring to the external feeding Ichneumonid (*Paniscus geminatus*) mentioned by Mr. Cushman, said that Hymenopterous parasites of naked hosts—that is, host insects not sheltered by a cocoon, or in a twig, or in a leaf—live internally as a rule, and that it is very rare indeed to find an external Hymenopterous parasite on an unprotected host insect. Almost the only exception that ocurred to him was that of *Euplectrus comstockii* How., which had been described many years ago by Mr. Schwarz. In fact, it sometimes happens that the same species of parasite, in its larval stage, will feed exteriorly upon a protected host, and interiorly upon an unprotected host,

In reply to Dr. Howard's remarks on external parasites of free living larvæ, Mr. Cushman stated that *Paniscus* does not belong strictly to this class since, although its egg is deposited on a free living larva, its feeding is done after the host has spun its cocoon.

——Mr. Schwarz, in remarking on the paper, said that most parasites of inside feeding larvæ are external feeders.

——President Busck stated that several parasites are internal feeders and mentioned the Solidago gall maker, *Gnorimoschema gallasolidaginis* Riley, which is commonly infested with polyembryonic internal parasites.

——Mr. Cushman said that *Tetrastichus hunteri*, a parasite of the boll weevil, is not only an internal feeder but also pupates within the host.

——Mr. Schwarz stated that *Adalia sanguinea* is common in Central and South America and is found only in the United States in tropical Florida. He referred to the first report of the Experiment Station of Cuba, in which Dr. George Dimmock pointed out the difference between the larvæ of *Adalia sanguinea* and *A. munda*. Finally he said that *Magilla maculata* is commonly found in low places.

——Mr. Cushman remarked here that most of the parasitized specimens from Vienna, Virginia, came from high ground.

EPIMECIS WILTII CRESSON AND ITS HOST.

By Raymond C. Shannon, *Bureau of Entomology.*

The life history of the Ichneumonid, *Epimecis wiltii* Cress., as far as could be ascertained, is entirely unknown. The observations here presented show that its larva is an external parasite of spiders. Another genus, *Polysphincta*, of the same family, has very similar habits, being also an external parasite of spiders.

While collecting with Mr. C. Shoemaker at Black Pond near the mouth of Difficult Run, Virginia, September 14, 1913, a spider, (*Epeira trivittata* Keys.) was found which had a very small parasitic larva, probably recently hatched, upon its thorax. The spider with larva attached was brought to the Museum and placed in a breeding jar, where the spider soon spun a web, in which it stayed. The larva grew gradually, while the spider remained alive, and apparently quite healthy, until the sixth day. The larva was then found to have grown to over twice the size that it had been the previous day. It was now hanging by two of its prolegs to a strand of the spiders web, and with its mouth thrust into the spider's abdomen, was supporting the dead and collapsed body of its host. The following morning it had dropped the spider and had spun its cocoon among the threads of the spider's web. The adult issued eleven days later, October 1, 1913.

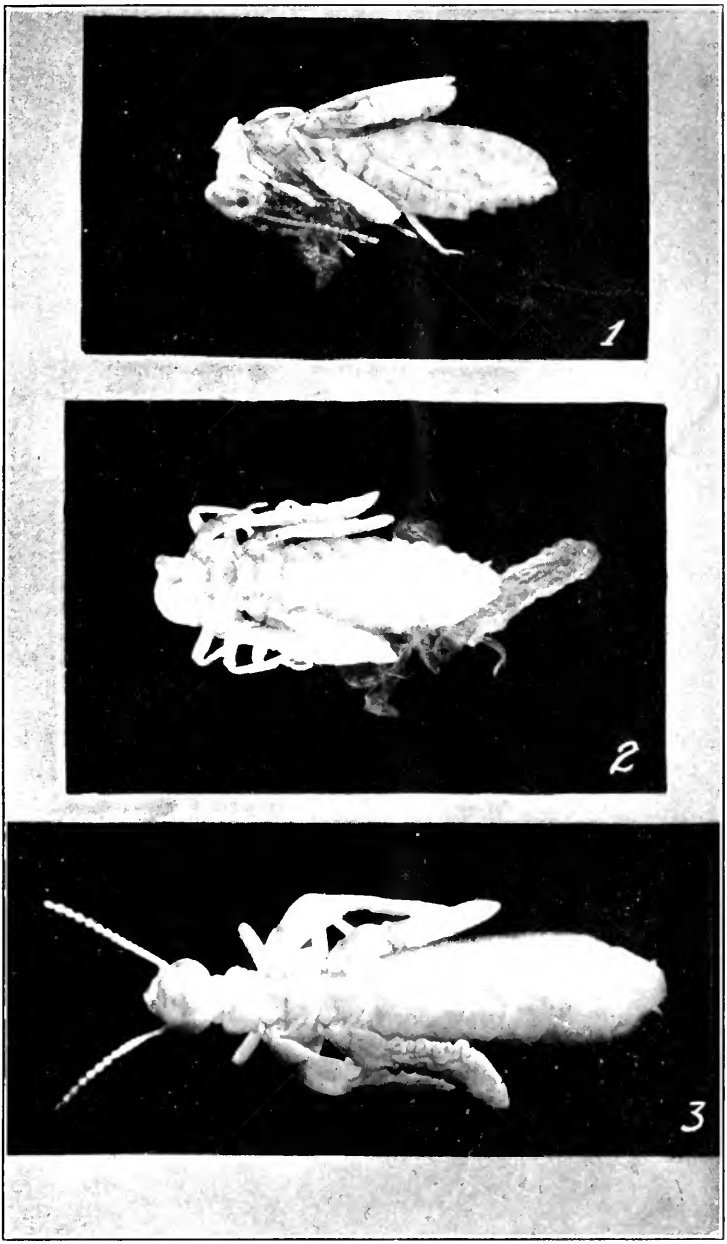
CHANGES DURING QUIESCENT STAGES IN THE METAMORPHOSIS OF TERMITES.

By Thomas E. Snyder, *Bureau of Entomology.*

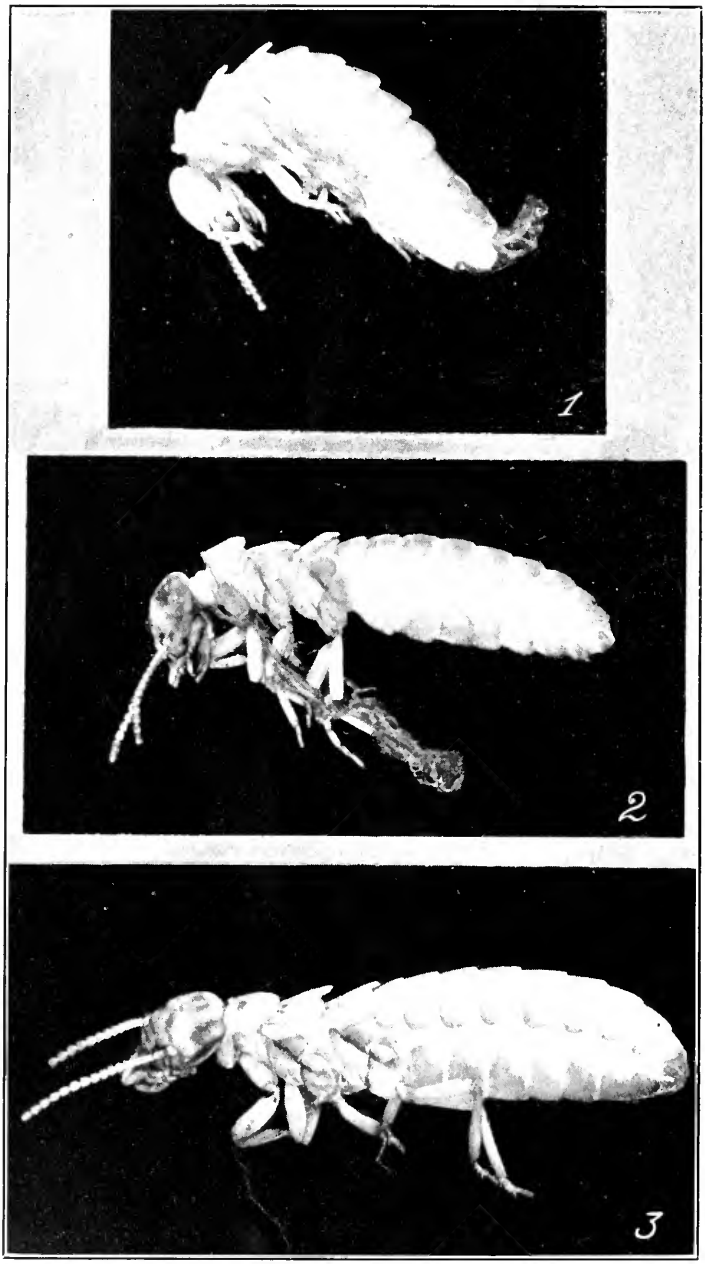
There have been several theories as to when the larvæ of termites become differentiated to the various castes in the social organization, the prevalent one being that undifferentiated larvæ are developed to the castes by the character of the food that they receive. The results of Heath's[1] experiments, however, to determine the relation of various kinds of food to polymorphism, were negative. In the case of ants, Wheeler[2] with Emery believes, "the adult characters to be represented in the germ as dynamical potencies or tensions rather than morphological or chemical determinants" and that "nourishment, temperature and other environmental factors merely furnish the conditions for the attainment of characters

[1] Heath, H. The Habits of California Termites. Biol. Bull., Woods Holl, vol. IV, December, 1902, pp. 47–63.

[2] Wheeler, W. M., The Polymorphism of Ants, Bull. Amer. Mus. Nat. Hist., vol. XXIII, January, 1907, pp. 1–93.



Leucotermes flavipes Kol., 1, Lateral View of the Quiescent Stage of Nymphs of the First Form, Skin Already Cast; 2, Dorsal View of Same; 3, Active Molted Nymph of the First Form With Wings Unfolding.



Leucotermes flavipes Kol., 1, Quiescent Stage of a Molting ♀ Nymph of the Second Form; 2, Molted ♂ Nymph of the Second Form or Neoteinic King, Cast Skin Still Attached to Legs; 3, Mature Neoteinic King.

predetermined by heredity." Bugnion,[1] studying *Eutermes lacustris* Bugn. and *Termes redemanni* Wasm. and *T. horni* Wasm. states that the differentiation takes place during the embryo stage for the three castes, rather than undifferentiated larvæ being developed to the castes by the character of the food they receive.

Observations by the writer of molting soldier larvæ of *Leucotermes* spp. and *Termopsis angusticollis* Walk. show that the differentiation of the soldier caste takes place during a "quiescent"[2] stage rather late in the life cycle. Differentiated nymphs of the first and second (?) forms of *L. virginicus* Bks. have been observed in the quiescent stage, 2.5 mm. in length. At this point a brief outline of the life cycle is necessary.

In the metamorphosis of the above species the eggs hatch into active, undifferentiated larvæ, which develop to the various mature forms or castes by a gradual growth through a series of molts and "quiescent" stages. During the quiescent stage both the larvæ and nymphs pass through an inactive period, of comparatively short duration, isolated, lying on the side, head bent down to lie on the ventral side of the body along which the antennæ and legs also lie extended in a backward direction. The writer first observed molting larvæ in a quiescent stage on August 11, 1911, in a colony near Jerseyville, Illinois. During April, 1912, the development of nymphs of the first and second (Lespès) forms of *Leucotermes flavipes* Kol. and *virginicus* Banks was observed at Falls Church, Virginia, and it was noted that both these nymphs (plates VI and VII) passed through a quiescent stage in the final molt to the reproductive forms; nymphs of the first form of *Termopsis angusticollis* Walk. also pass through the quiescent stage. From the first to the middle of August 1913, freshly molted pigmentless soldier nymphs of *flavipes* in the stage preceding maturity were noticeable in colonies in Virginia. On August 17, 1913, molting soldier larvæ were found in the quiescent stage in a colony of *virginicus* at Chain Bridge, Virginia. During the quiescent stage differentiation took place. Larvæ to all external appearances undifferentiated or of the worker type (as shown by the head, mandibles with marginal teeth and labrum of the still adhering larval skin), the individuals (*virginicus*) being over 3 mm. in length in the quiescent condition, antennæ with 14 segments, develop at this molt to pigmentless nymphs of soldiers with more elongate, soldier-like head, and sabre-like mandibles without marginal teeth. In this stage the head, mandibles, labrum, and "menton" (Bu-

[1] Bugnion, Pr. E. La différenciation des castes chez les Termites. Bull. de la Société entomologique de France, No. 8, April, 1913, pp. 213–218.

[2] Strickland, E. H., A Quiescent Stage in the Development of *Termes flavipes* Kol. Jour. N. Y. Ent. Soc., vol. XIX, No. 4, December, 1911, pp. 256–259.

gnion) have not attained the shape or length of those of the mature soldier, there being at least one later molt to maturity. After the first radical change the head is pigmentless (the only pigmentation is at the inner margin at the tips and base of the mandibles and the tips of the maxillæ) not elongate, rounded, tapering towards the base, (broad at apex) mandibles shorter and broadening at base; labrum elongate, sub-elliptical, (tapering at apex and slightly at base), wider than in mature form; "menton" convex, tapering, toward base, wider than in mature form.

After the next molt, the nymph is as yet shorter than at maturity, 4.5 to 5.5 mm. in length (*flavipes*) and the head is more elongate but still broader at the apex; mandibles, labrum, and "menton" more elongate and slender. Antennæ with 14 to 15 segments. At this stage the mouth parts and borders of the antennal sockets are slightly pigmented. After another (?) molt, the mature size is attained and pigmentation of the chitinized parts is taken on.

Freshly molted, immature, pigmentless soldier nymphs of *Termopsis angusticollis* Walk. have just been observed among specimens collected by B. T. Harvey at Ashland, Oregon, August 28, 1913.

It will be noted that there is a gradual elongation of the parts, as the mandibles, labrum, and "menton," and that these parts become more slender and lose in width. In this connection, it might be of interest to state that in the neoteinic reproductive forms (nymphal forms with short wing pads developed from nymphs of the second form) the head, thoracic and abdominal tergites and sternites are both longer and broader than in the reproductive forms that develop from nymphs of the first form, i.e., the structure at this retarded early stage is more gross.

In case of the nymphs of the sexed forms during the final molt, i.e., from nymph to reproductive forms, the females of both nymphs of the first and second forms normally[1] lose the genital appendices which are present in both sexes prior to this molt but afterwards only in winged males and neotinic male reproductive forms. However, egg-laying complementary queens, (with no indication of wing-pads) of *Termopsis angusticollis* Walk. have been observed with genital appendices; though they are absent in true queens of this species. After this molt and quiescent stage nymphs of the first form of *Leucotermes* spp. and *Termopsis angusticollis* Walk. acquire wings and mature pigmentation and are colonizing sexed adults ready for flight. Nymphs of the second form acquire a characteristic pale pigmentation and develop to the neoteinic reproductive forms. The whole period intervening between the

[1] Grassi and Sandias, Blandford's Trans. in Quart. Jour. Micros. Sci. vol. 39, pt. 3, n. s. 1897. (*Leucotermes lucifugus* Rossi.)

nymph ready for the final molt and fully pigmented winged adult is only one day and one-half to two days for individuals, (*Leucotermes* spp.) the quiescent stage lasting several hours.

In conclusion, therefore, it may be stated that in case of *Leucotermes* spp. and *Termopsis angusticollis* Walk., the differentiation of the soldier caste occurs during a molt and quiescent stage rather late in the life cycle of the insect, the larvæ being previously, to all external appearances, undifferentiated.[1]

——In discussion Mr. Banks said that discoveries of Mr. Snyder regarding the metamorphosis of Termites upset the old methods of classification. The change from the metamorphic to the non-metamorphic forms is so gradual that a classification cannot be based on these characters.

——Professor Quaintance asked if a breaking down of the tissues takes place during metamorphosis.

——Mr. Banks said there must be some change in the local parts, but not nearly as much as in the Diptera.

FEEDING HABITS OF PHLEBOTOMUS VEXATOR COQ.

By Raymond C. Shannon, *Bureau of Entomology.*

The following recent observations by Dr. Paul Bartsch and the writer tend to show that *Phlebotomus vexator* feeds normally upon reptiles rather than upon warm-blooded animals.

Late in the evening of July 19, 1913, a large copperhead snake was shot and badly crippled at Plummer's Island, Maryland. It still showed life the following morning when it was found to have numbers of small bloodsucking flies, *Phlebotomus vexator*, feeding upon it. The flies had their beaks inserted between the scales of the snake. Several hours later, (about 10 a.m.), there were still a number of these flies feeding, and some were so heavily engorged that they were unable to fly. Males were present, two being seen in copula with females.

The morning of the same day (July 20), Dr. Bartsch caught a black snake at Paris, Virginia, which had in addition to numerous ticks, a few of these same flies sucking blood in the same manner

[1] Knower, H. McE. Origin of the Nasutus of Eutermes, Johns Hopk. Univ., Circ. XIII, 1894.

above described. These were greatly distended with blood, and were so intent on feeding that he was able to pick them off and place them in alcohol.

One ♂ the first five specimens from which Coquillett described the species, (Ent. News, vol. 18, 1907, p. 102) was found in the early morning on the floor of the cabin at Plummer's Island, beside a blanket on which a person had been sleeping during the night. It was so heavily engorged with blood, supposedly from the sleeper, that it could not fly.

In view of the abundance of *Phlebotomus vexator* about the cabin on Plummer's Island during June and July, it seems remarkable that no observations of its attacking man, have been made. Its nocturnal habit, with possibly a painless bite and silent flight, may explain this. Another species found in Guatemala, *Phlebotomus cruciatus* Coq., was observed by Mr. Barber to bite man and cause annoyance, (see note by Barber, Proc. Ent. Soc. Washington, vol. 8, 1906, p. 102).

In India a species of *Phlebotomus* has been observed sucking the blood of a toad. (Maxwell Lefroy, H., A Preliminary Account of the Biting Flies of India, 1907 p. 16).

——Mr. Knab said that Mr. Shannon's observations were very interesting in that they showed a well marked difference in the feeding habits of the different species of *Phlebotomus*. This is strikingly confirmed by observations recently made in another part of the world. It is recognized that *Phlebotomus papatasii* of the Mediterranean region, which is the vector of the so-called pappataci fever, is associated with man in much the same way that are certain species of mosquitoes, frequenting houses and the females sucking his blood. It has been assumed that the other species of *Phlebotomus* also readily attack man. F. M. Howlett, in a paper which has just come to hand, now shows that another species common in the Orient has a marked preference for the blood of Geckos (Indian Journ. Med. Research, vol. I, pp. 34–38, pl. 9; July, 1913). Howlett states that *Phlebotomus minutus*, in its biology, is closely associated with these lizards. He shows that the geographic distribution of *Phlebotomus minutus* and of the Geckonidæ correspond very closely. Furthermore, *Phlebotomus minutus*, whether in houses or out-of-doors, is always associated with the Geckos, and it is useless to seek it elsewhere. The larvæ

of *Phlebotomus minutus* are found in crevices between bricks and stones, where the Geckos hide and where the excrement of the lizards furnishes them suitable nourishment. But the association with the Geckos is closest in the adult females, as these normally suck the blood of the lizards. "In a bungalow in which *P. minutus* is fairly abundant, careful examination of the lizards on the wall, at almost any time of day or evening, may reveal that perhaps every other lizard has a sand-fly perched on its back and sucking its blood. . . . I believe that there is no doubt that the flies have a distinct preference for biting lizards as compared with men; that they are, in fact, primarily parasites of the lizard. To us they are troublesome only in the hot months, generally in the late evening or very early morning, and it is extremely difficult to get them to bite the hand or arm in the laboratory during the day. Geckos confined with sand-flies are, on the other hand, freely bitten at any hour of the day, as well as in the evening, and one lizard may have several flies biting at once, this may happen, moreover, just after the flies have completely refused to bite a human wrist."

Professor Quaintance exhibited specimens of cranberries having numerous galls on the leaves and asked for information as to what was the cause of the peculiar growth. Mr. Banks suggested that it might be caused by the mite, *Eriophyes vaccinii*, or some Cecidomyiid.

——Mr. Banks exhibited specimens of a Psyllid, *Livia marginata* Patch, taken near Falls Church, Virginia, on the leaves of a sedge. This species was figured by Miss Patch in Psyche from two specimens from Connecticut. The insect deforms the lower leaves of the sedge to form a tuft of white leaves that are very prominent.

——Mr. Knab discussed the life history of *Dermatobia*. Infestation of man with the larva is common in the American tropics and the larvæ are also common in cattle, horses, and other mammals. Nothing has been known of the manner of infestation, and it has been assumed that the eggs are deposited directly on the host. The probability that the infestation is not direct was indicated by the large number of eggs (750 to 800), found by Neiva in dissections. Now Surcouf of Paris has received South American

mosquitoes (*Janthinosoma*) with clusters of eggs of *Dermatobia* attached beneath the wings. It would appear, then, that the eggs hatch and the larvæ are transferred to the host, while the mosquito sucks blood. As to the manner in which the eggs are attached to the mosquito, Surcouf accepts the explanation of Gonzales-Rincones of Venezuela, who had transmitted the specimens. The latter is credited with a statement that the eggs, along with a viscous substance, are deposited upon the foliage and that they become attached to the mosquito accidentally as it walks over the leaf. This explanation, the speaker said, he could not accept. The eggs were found attached to a part of the mosquito's body which does not come near the leaf surface when the mosquito rests upon it; also the eggs are attached in a definite way by their bases and with the hatching end outward, and this could hardly be accomplished accidentally. Furthermore, under the circumstances assumed, the eggs for the most part would be picked up by other insects, which would not bring about their transfer to a suitable host. There is no reason to doubt that the eggs discussed by Surcouf are really those of *Dermatobia*, and his statement shows that these eggs have been repeatedly found attached to mosquitoes. Remarkable it is that in every case the mosquito appears to have been a *Janthinosoma*. Prof. Urich, of Trinidad, has called Mr. Knab's attention to the fact that he has also found *Janthinosoma* with the eggs attached, and that in 1905 he sent such a specimen to the Bureau of Entomology, but that he received no satisfactory explanation.

——Dr. Martini gave a short address, thanking Dr. Howard and other members of the society for the help they had given him. He stated that before leaving Hamburg, he had been informed that he would be able to obtain much assistance while here, but he found upon his arrival even more help than he had anticipated.

——Dr. Howard gave a brief account of his western trip in company with Dr. Marchal, mentioning a few incidents that occurred during the journey.

——Mr. Schwarz spoke of the occurrence of *Psylla buxi* Linn. He said he had observed this insect in great numbers at Atlantic City many years ago. Mr. Banks said that he had taken this insect two or three years before in New York City on box hedge.

——Dr. Hopkins called attention to the probable introduction of a destructive European Scolytid into this country, specimens of *Myelophilus piniperda* L. having been recently sent to him for identification by Dr. T. J. Headlee, of the New Jersey Experiment Station, with the statement that it had been found boring in living shoots of pine in one locality of his state.

Dr. Hopkins also mentioned a record by Dr. Leconte in 1868 of this insect from New York, but it had never been known whether it was collected in the field, or had come from some collection of foreign insects through a mistake in labeling.

FOREST MALARIA.

By Dr. A. Lutz, *Rio de Janeiro.*

I have received from Doctors Knab and Dyar answer to my statements concerning the transmission of malaria by wood mosquitoes, in which they not only refuse to be convinced but repeat their accusations of overlooking and misunderstanding elementary facts. I only want to make plain, why I have protested and leave it to the members to decide, if their way of arguing ought to be approved.

In order to suit their theory Galli-Valerio must have mistaken another anophelid for *Myzomyia lutzi*, though this is an extremely characteristic species which can be distinguished from all others by a glance at the scutum. Lutz and Chagas must have overlooked the presence of other anophelids at the places of their observations. Now Lutz and Chagas might be expected to know anophelids, as they worked with them for years and together indicated most of the Brazilian species. Both made formal declarations and I have a written statement from Dr. Chagas to the point that he looked carefully for other anophelids while he treated the epidemic on the spot. At that time he did not know me, nor my paper and made his observation quite independently. Those facts are considered of no account, because Dr. Knab found in Central America other anophelids, in localities which he takes to be similar. He even mentions *Anopheles eiseni*, a species which has never been found in the states of Rio and São Paulo where the observations were made. I am also accused of overlooking that men are men, and it is stated that the men must have got away at night and infected themselves elsewhere. I have already declared that they lived many miles away in the woods and there was no

other way to travel than on foot. Even if they had escaped control, the nights would not have been long enough to let them reach a place where they might have found what is suggested, nor would that help in any way, as there was and is no malaria in those places. Arguing like that you might also say that the Italian sailors who got yellow fever on board of a man-of-war anchored in Rio harbor far away from the land, were attacked because they swam on shore at night time, following a classical example.

Messrs. Dyar and Knab think that mosquitoes, which have never been in contact with men before, cannot transmit disease. In order to test their thesis, you must put men in absolutely uninhabited places. This is, generally speaking, rather difficult, but it so happens that in Brazil roads and railways have been made in such conditions and nearly always there have been epidemics of malaria. I know also of epidemics of Leishmania sores, with good reasons attributed to the transmission by *Phlebotomus*, observed in absolutely deserted zones. I have also seen a small yellow fever epidemic amongst people living in a place where only wood mosquitoes could be expected. All this shows that the theoretical considerations have not been respected by the facts and all that is wanted is that the transmitter, whatever may be its past, belong to a category in which the parasite can thrive; then it must have repeated access to human beings, some of them being infected and some not immune. As the process of development takes time, its life must not be too short. For that reason repeated oviposition is a favorable condition.

Thus the discussion from my side is closed but I fully maintain the correctness of my observations.

ON A COLLECTION OF NEUROPTEROID INSECTS FROM THE PHILIPPINE ISLANDS.

By Nathan Banks, *Bureau of Entomology.*

During the past year Prof. C. F. Baker has been sending me Neuropteroid insects from the Philippines for determination. Hardly any forms were recorded previously, and since most of them are new, it is desirable to publish the descriptions. Hardly sufficient material is yet available to show the relationships of the fauna, and very little is known from Borneo, but from Java a considerable number are described and some of these occur in the Philippines, but more often related species.

The 39 species here recorded are all from one island of the group and from a restricted part of that island. It is therefore probable

that the total fauna in these groups of insects will amount to several hundred species. The Psocidæ and the Trichoptera will be particularly rich in new species, while the several families like Panorpidæ and Coniopterygidæ as yet unrepresented will be found to occur in several species.

PSOCIDÆ.

Myopsocus enderleini Bks.

From Los Banos.

Cæcilius sp.

Two specimens from Los Banos; a plain unmarked species.

Psocus bakeri n. sp.

Markings in general similar to *P. cosmopterus*, especially the apical band of wings, the basal band runs obliquely across up to the radius, and is very broad behind. The stigma is prominently, uniformly reddish (not yellowish), and behind it is angulate. The first long joint of the antennæ is (except tip) pale yellow, not at all brownish; legs pale, tips of tibiæ and tarsi blackish. The radial sector and the median vein are united only at a point, and in some cases even connected by a short cross-vein.

From Los Banos, Philippines (Baker), on bark of tree in forest. Because of the shape of the median cell, and of the angulate stigma, and slightly different markings I think it is a separate species rather than a variety of *P. taprobanes*, these characters hold in all the numerous specimens. It is a size smaller than the Javan *P. taprobanes* in my collection.

Tæniostigma bimaculata n. sp.

Very pale yellowish throughout, with two large shining black spots on the mesonotum, one on each side lobe; antennæ deep black and black haired, basal fifth of the fourth (and others beyond) joint is white; no spot on head; last tarsal joint black, rest of legs pale. Wings with the lower border of the stigma brown (like *T. ingens*), the cubital vein also black and black bordered; the median cell much broader at tip than in *T. ingens*, and the median and radial sector united for a longer distance than in that species the "areola postica" has a very narrow base above on the median vein, scarcely one-half as long as that of the apical cells; radial sector forks a little before last branch of the median. Length, 7 mm.

From Los Banos, Philippines (Baker).

PERLIDÆ.

Neoperla clarissa Bks.

From Los Banos.

Neoperla recta n. sp.

Brownish, a dark spot on the clypeus; antennæ beyond first joint is black for some distance; setæ black at tips, tibiæ dark, wings with brown tinge, and brown venation. Ocelli large, about diameter apart, fully as close to bosses, which are situate about as far from eyes, clypeal margin truncate; pronotum strongly convex in front, much narrowed behind, surface rugulose. In fore-wings radial sector with three branches in female, two in male, in all cases with a few cross-veins between them; about 7 median, and 6 cubital cross-veins, and four cubitals in hind-wings, the veinlet connecting radius and sector straight; the first axillary in hind-wings ends in four branches, not connected to next axillary. The ventral plate of female is simply slightly, evenly convex. Expanse, female 35 mm.; male 27 mm.

Los Banos and Mt. Makiling.

Neoperla obliqua n. sp.

Wholly pale yellow; eyes and ocelli black and base of antennæ (except basal joint) rather dusky. Ocelli small, much more than diameter apart, as close to each other as to the bosses, these latter much nearer to the eyes; clypeal margin rounded; pronotum broader in front than head, a little narrowed behind, front margin only slightly convex, surface rugulose. Wings with venation pale yellow; no cross-veins in apical part of wing; radial sector with two branches beyond anastomosis, about 8 median, and 6 cubital cross-veins, in hind wings only 3 to 5 cubital cross-veins, the first axillary in hind-wing ends in three branches, one connected to next axillary; in the fore-wings the veinlet connecting radius and sector is strongly oblique. In female the ventral plate is not developed. Expanse, 35 mm.

From Mt. Makiling.

MYRMELEONIDÆ.

Formicaleon cleonice n. sp.

Head yellowish; a dark band below antennæ, and a fainter band above them; vertex with two rows of connected spots; pronotum with a broad median dark stripe, divided by a pale median line, and sides dark, between these dull gray yellowish, not clear, two long black bristles each side and lower sides with long white hairs; rest of thorax with median pale line, and interrupted pale stripe each side; pleura pale, with few dark spots. Abdomen dull blackish, first segment pale above, second with pale basal streak, forked behind, at middle of second and third segments is a distinct black spot, other segments pale on base, but not clearly marked, last segments with pale at each apical lower corner. Legs pale, femora infuscated above, tibiæ with premedian dark band, and other spots and dots, hind tibiae with dark line on inner side, tips of tarsal joints dark. Wings hyaline, veins with dark spots, radius with longer dark spaces, outer gradates dark,

forming an oblique streak, and the forkings of veins beyond are dark, stigma barely distinct, cross-veins dark at ends; in hind-wings there is a dark dot at end of median and cubital veins. Antennæ rather long and slender, annulate throughout with dark; pronotum planly broader than long, not narrowed in front; abdomen shorter than the wings; wings shaped as in *F. dirus* and *F. morpheus*, eight cross-veins before the radial sector in fore-wing; thirteen branches to radial sector, about 48 costals before stigma; legs rather short, spurs as long as three joints or a little more, last tarsal joint as long as others together. Expanse, 76 mm.

From Los Banos, Philippine Islands (Baker.) Closely related to *F. dirus* (of Ceylon)and *F. morpheus* (which occurs in several Malay Islands, Java, etc.), but abdominal marks will distinguish it at once; the Ceylonese *F. gravis* and the Australian *F. vafer* are also different, and not closely related to *F. dirus*.

Formicaleon disjunctus n. sp.

Dark brown, with paler brown marks. Face below antennæ yellow, tips of antennæ pale, vertex with a transverse row of six rufous spots, the lateral next to eye, the inner pair contiguous; pronotum with a gray median line, not distinct, outer margin blackish, mesothorax with large gray spot behind and a median line in front, and a short gray line on each lateral lobe; metathorax mostly gray above, but with a black mark at inner anterior part of lateral lobes; abdomen with pale transverse spots at base and before middle of several segments; legs pale, tips of last tarsal joint, tip of tibiæ and middle of fore and mid-tibiæ black, black and a few white bristles on legs, many are much longer than width of the joint, femora rather densely clothed with fine white hair. Wings hyaline, veins interrupted black and white, ends of many cross-veins dark, but others wholly pale, base of stigma dark, a dark spot on the cross-vein behind it and on cross-vein beyond; gradates and outer forkings clouded with dark, and a spot at end of anal vein of the fore-wings. Antennæ long and slender; pronotum little longer than broad, and slightly narrowed in front; spurs equal two; tarsal joints. Wings rather slender, acute at tips, six cross-veins in fore-wing before radial sector, 9 branches to radial sector, 5 cross-veins between anal and cubital fork in fore-wings, one such veinlet in the hind-wings; gradates much disjointed, in three series, the anterior a row of 5, behind are two rows one before of four veinlets, and one beyond the anterior row of three veinlets; behind the stigma the cross-veins are almost in even rows. Expanse, 57 mm.

From Los Banos and Mt. Makiling, Philippine Islands (Baker).

ASCALAPHIDÆ.

Suhpalasca princeps Gerst.

One from Los Banos; described from Java.

CHRYSOPIDÆ.

Ancylopteryx 8-punctata Fabr.

Several from Los Banos; common in Malasia.

Ancylopteryx doleschali Brauer.

From Los Banos; known from Amboina.

Nothochrysa inæqualis Walk.

From Los Banos; a common species from India and Insulinde, and redescribed by various writers.

Nothochrysa evanescens McLach.

From Los Banos; one specimen is of the variety *everetti* van der Weele. Recorded from nearby islands.

Chrysopa isolata n. sp.

Wholly pale yellowish green, (probably green when alive) stigma deeper green, a black dot each side at base of clypeus, otherwise unmarked. Pronotum much broader than long, slightly narrowed and rounded in front, transverse groove about in middle. Wings slender, apex acute, venation unmarked, 14 costals before stigma, 3 or 4 inner gradates, 6 to 7 outer ones, the inner series is nearer to outer than to radial sector, and each of inner series is farther from next than its own length, outer marginal forks not twice as long as broad; divisory veinlet ends beyond the cross-vein, second cubital cell about as long as the third, narrowed at tip, but near base about as wide as the third. Hind-wings with two or three very widely separated gradates in inner series, and five or six in outer row; 8 radial cross-veins; in fore-wings 9 or 10 radial cross-veins. Expanse, 22 mm.

Los Banos, Philippine Islands (Baker). Near to *Ch. noumeana* Navas (which I have seen in Paris) but the arrangement of gradates is very different.

Chrysopa tagalica n. sp.

Pale greenish, face yellowish, a yellow median stripe through thorax, antennæ yellow, no marks on head, palpi nor antennæ; wings hyaline, with green venation, stigma rather more distinct. Wings slender, acute at tips, divisory veinlet ends beyond the cross-vein, second cubital cell about as long as the third, both narrowed toward each other, 10 radial cross-veins; in both wings 5 inner gradates and 6 outer, the two series wide apart, the inner much nearer, especially above, to the radial sector than to the outer, and outer much nearer margin than to inner, outer marginal forks about twice as long as broad. Expanse, 22 mm.

From Los Banos, Philippine Islands (Baker).

Probably related to *Ch. ochracea*, (which I have not seen) but latter is darker, with marks on thorax.

Apochrysa bellula n. sp.

Yellowish, head mostly bright red, all over face to clypeus and over anterior part of vertex, not leaving pale around antennæ; basal joint of antennæ faintly brownish in front; pronotum wholly pale; rest of thorax, above, except lateral margin, blackish or dark greenish. Fore-wings with black spot on inner gradates, in fore-wings part of radial sector near stigmal region is black, the inner gradates, three of outer, and the cross-veins beyond the union of medius and cubitus are black; in hind-wings only these latter cross-veins black. The fore-wings are about once and one-half as broad as hind-wings. Expanse, 54 mm.

From Los Banos.

Related to *A. albarda* but middle area of wing broader, and no spot on outer gradates. From *A. coccinea* it differs in more red on head, no stripe on pronotum, and broader hind wings. *A. aurifera*, is very distinct, and also from *A. albarda* in that the first black spot is nearer to base of wing.

HEMEROBIIDÆ.

Sisyra bakeri Bks.

From Los Banos; the first record of the genus is Insulinde.

Micromus pusillus Gerst.

From Los Banos; recorded from Java.

Notiobiella affinis Bks.

From Manila.

OSMYLIDÆ.

Spilosmylus modestus Gerst.

Mt. Makiling. Known from Java.

MANTISPIDÆ.

Climaciella luzonensis van der Weele.

Several specimens of this handsome species from Los Banos; described from the Islands.

Mantispa luzonica Navas.

Apparently common at Los Banos.

Euclimacia tagalensis n. sp.

Body rufous throughout, no marks on face, a black band across posterior vertex, the extreme base and apex of antennæ pale yellow, scutelli pale yellow, with the mark extending down on the pleura; a narrow band at base of prothorax black, and dark spots over base of wings; no marks on the abdomen, the anterior femora with faint dark cloud each side near tip. Face irregularly rugose, with short ridges; antennæ short and stout; pronotum short, anterior part very broad, behind the constriction are two roughened tubercles (as in *E. strenua*), and behind these are sulci. Wings long and slender, costal portion embrowned, but not very darkly, fading off behind, broader at base, very faint, but broad at tip. Venation very similar to that of *E. partita* (as figured by Enderlein); costal area very narrow, 11 costals in fore-wing, 9 in hind-wing, 5 cross-veins beyond the stigma; 14 discal cells. Expanse, 36 mm.

From Los Banos, Philippine Islands (Baker).

Mantispa enderleini n. sp.

Similar to *M. amabilis*, but distinguished by the radius being clear yellow out to the stigma. Yellow; a brown stripe from between antennæ down to the mouth; antennæ brown, except the yellow base; a brown spot each side the base of antennæ; pronotum with brown anterior marginal line, some dark spots on the thorax and pleura, abdomen mostly yellow, a black spot at apex of each segment above, broadened out behind, ventral segments margined with dark; legs pale yellow, femur is mostly blackish within, a median brown cloud on the outer side. Wings hyaline; stigma reddish long and slender; venation black, but the radius in both wings is yellow. Base of the median, and the anal vein, also yellow. First radial cell with one branch, second and third each with two branches; cells beyond end of stigma broader than long; six costal cross-veins. Length 10 mm.

From Los Banos, Philippines (Baker).

TRICHOPTERA.

Anisocentropus magnificus Ulmer.

One from Los Banos; described from the Islands.

Notanatolica magna Walk.

From Los Banos; widely distributed in Malasia even from Australia to Japan.

Notanatolica opposita Walk.

Several from Los Banos; not as widespread as *N. magna*.

Œcetinella confluens Ulmer.

From Los Banos: described from Celebes.

Leptocella bakeri n. sp.

Pale whitish yellow; antennæ beyond the basal third marked with brown; wings with a few dark brown patches; two near the base, one at base of discal, and one at base of median cell, one above middle of discal cell, a smaller one at base of stigma, and one at base of each of the apical forks, the first rather the smaller; the anastomosis dark, especially behind; legs and body pale yellowish. Wings slender as usual; the median cell arises about its width before the discal, forks one and three equal, with pedicel one-half as long as the fork, fork five truncate at base, discal cell not drawn up by a cross-vein towards the radius. In hind-wings the costal venation faintly indicated. Expanse, 18 mm.

From Los Banos, Philippine Islands (Baker).

Setodes apicipennis n. sp.

Pale yellowish; basal joints of the antennæ very large, palpi gray haired, rather darker toward tips. Wings pale yellowish, long, slender, acute at tips, costal hairs nearly clear yellow, others dull yellowish; anal area blackish, some black scale-like hairs along the veins; a black spot at stigma, and one below it on the base of fork one; outer margin beyond the stigma around to the opposite side on the hind margin with seven black spots, each at the end of a vein; outer fringe gray, at anal angle very long; hind-wings very slender, hyaline, with long gray fringe, one and one-half times as long as the width of the wing. Legs very slender, pale yellow, tips of tibiæ and the tarsi dark, but in middle legs the last two tarsal joints are white. Expanse, 10 mm.

From Los Banos, Philippine Islands (Baker).

Tagalopsyche n. gen.

Venation very similar to *Setodes*, fore wings with forks 1, 3, and 5, also in hind wings. Spurs 0 (or 1), 2, 2. No spur is visible on the front tibia, but it may have been broken. There are no hairs on the surface of the wing, but the veins have a row of hairs, all pointing the same way. It differs from all Leptocerids in the broadly rounded apical part of fore-wing, and from *Setodes* also in the much broader hind-wings. Maxillary palpi with second, third, and fourth joints very long, the third contracted in middle, all with only a few erect hairs.

Tagalopsyche sisyroides n. sp.

Rich, uniform, dark, chocolate brown. Antennæ pale yellow, beyond a few basal joints the tip of each joint is faintly dark; legs rather pale, but mostly dull brownish, the apical half of the hind tarsi pale, front tibia

pale; abdomen black, short, no distinct appendages, but short processes below and in middle. Fore-wings with a hyaline white dot on the thyridium; hind-wings dark like the fore pair, the posterior fringe quite long and black. Expanse, 11 mm.

From Los Banos, Philippine Islands (Baker).

Dipseudopsis nervosa Brauer.

From Los Banos; described from the Islands.

Dipseudopsis nebulosa Albarda.

Two from Los Banos; known from Sumatra.

Dipseudopsis luctuosa n. sp.

Head reddish yellow, a median vertical black mark on face; vertex with a median black stripe; palpi black; antennæ blackish, except a few basal joints are yellow; pronotum yellow, black on the lower sides and in front; rest of thorax dull blackish; abdomen dark, with apical margins of segments, above and below, pale; legs yellowish, rufous on tips of tibiæ and on the tarsi, front coxæ black. Wings dark brown, with white hyaline spots and streaks as in the figure; a long streak below radial sector, one over bases of third, fourth and fifth apical cells, three elongate spots near anal angle, and streaks in basal part in cubital and median areas. Hind wings dark, but paler near base and in middle of some of the cells. In fore-wing fork 1 is rather longer than its pedicel, second fork a little back on discal cell, third with a very short pedicel, fourth extends back on median cell about width of that cell, fifth not reaching the cross-vein at base of median cell. Spurs as figured. Expanse, 38 mm.

From Los Banos, Philippine Islands (Baker).

Hydromanicus cinctipennis n. sp.

Body dark, antennæ dark, toward base almost black, serrate within; palpi dark, last joint extremely long; vertex deep black in middle. Wings similar to *H. fasciatus*, with a white band, but general surface is darker than *H. fasciatus*. Venation closely similar to *H. fasciatus*. Distinct from *H. fasciatus* by dark (instead of yellowish) head, thorax, and legs, and rather larger than that species. Expanse, 16 mm.

From Los Banos, Philippine Islands (Baker).

Hydropsychodes costalis n. sp.

Body dark brown, or blackish; antennæ pale, in the female marked with brown in a spiral manner; head and thorax with some golden yellow hair; legs pale, dark at tips of the tibiæ, hind tibia all dark, tarsi mostly dark, leg 1 of male pale. Wings dark brown, darkest along costal area, and here, with three large yellowish spots with irregular margins, one at the stigma

and two before it, another large irregular spot at the anal angle, broken above by dark spots; some connected yellowish spots near base of wing, and a number of small spots in discal part of wing. Hind-wing infuscated, with two paler costal spots, one each side of the stigma. Venation practically the same as *H. kræpelini*, fork I in fore-wings as long as its pedicel, the cross-veins behind base of the median cell not interstitial; in hind-wings fork III is a little longer than in *H. kræpelini*. The lower appendages of male are greatly thickened at tip. Expanse, 10 mm.

From Los Banos, Philippine Islands (Baker).

Ecnopsyche n. gen.

A Hydropsychid, with distinct ocelli, venation of four wings very similar to *Hydropsychodes* and *Ecnomus*, especially in anal veins and short fifth fork, spurs, 2, 4, 4. Fore wings with forks 1, 2, 3, 4, 5; hind wings with forks 2, 3, 5; discal cell in both pairs closed, and in both a cross-vein from discal cell to the radius. Antennæ with long, slender joints; maxillary palpi with joints two and three subequal and fusiform, fourth cylindrical and equal to third, fifth twice as long as the fourth.

This genus, by presence of ocelli, would go in Ulmer's family *Philopotamidæ*, but the venation is very different from any genus therein, and more allied to true *Hydropsyche*. *Stenopsyche* has venation also very different from *Philopotamus*, and so I cannot consider the presence of ocelli as a family character. Likewise Ulmer puts *Ecnomus* in the *Polycentropidæ* because of the 3, 4, 4 spurs, but I agree with McLachlan in considering this genus closely related to *Tinodes*, so that a family, *Polycentropidæ*, based on the spur formula, is to me, an unnatural association, and I prefer to keep the family *Hydropsychidæ* in the old sense, with many small groups based on various characters under it. It may be well here to record the fact that the *Hydropsychidæ* differ from other caddice flies in lacking bristles on the dorsum of the thorax, fine hair only being present.

Ecnopsyche reticulata n. sp.

Yellowish; antennæ very faintly darker at tips; vertex with rather sparse golden hair; wings pale yellowish, reticulate with pale brown, which forms many bands connecting the veins, rather dark at anastomosis, on the outer margin. The wing is pale brown, with many small hyaline spots, indistinct dark spots at the ends of the veins; venation yellowish; hind-wings hyaline, venation yellowish, especially near the costa. Legs pale yellow, very slender, spurs more rufous; abdomen dull black, genitalia yellowish. Lower appendages of male no larger at tip than at the base, the apical joint very slender. Expanse, 15 mm.

From Los Banos, Philippine Islands (Baker).

Polycentropus sp.

One from Los Banos; may not belong to genus in restricted sense.

Chimarrha luzonica n. sp.

Head yellowish, antennæ pale yellowish, palpi dark brown, erect hair each side on vertex; thorax and abdomen dark, legs pale yellowish, but the spurs dark brown; wings gray blackish, nearly uniform, with sparse black hairs, veins darker; hind wings colored like fore wings, fringe black at tip, gray behind, fork 3 of hind-wings with a very long pedicel, fully twice as long as the fork; discal cell of fore wings rectangular, anal veins separate at ends. Expanse, 10 mm.

From Los Banos, Philippine Islands.

EXPLANATION OF PLATES.

Fig. 1. *Chrysopa isolata,* cubital cells.
Fig. 2. *Tagalopsyche sisyroides,* wings.
Fig. 3. *Dipseudopsis luctuosa,* wing, and spur.
Fig. 4. *Dinarthrodes niger,* male appendage.
Fig. 5. *Dinarthrodes niger,* head and antenna.
Fig. 6. *Echnopsyche reticulata,* wings.
Fig. 7. *Tagalopsyche sisyroides,* palpus and genitalia.
Fig. 8. *Chimarrha luzonica,* fore wing.
Fig. 9. *Hydromanicus cinctipennis,* genitalia.
Fig. 10. *Neoperla recta,* head and part of wing.
Fig. 11. *Echnopsyche reticulata,* genitalia.
Fig. 12. *Neoperla obliqua,* head.
Fig. 13. *Dinarthrodes niger,* fore wing.
Fig. 14. *Hydropsychodes costalis,* genitalia.
Fig. 15. *Leptocella bakeri,* genitalia.
Fig. 16. *Chrysopa tagalica,* cubital cells.
Fig. 17. *Neoperla obliqua,* part of wing.

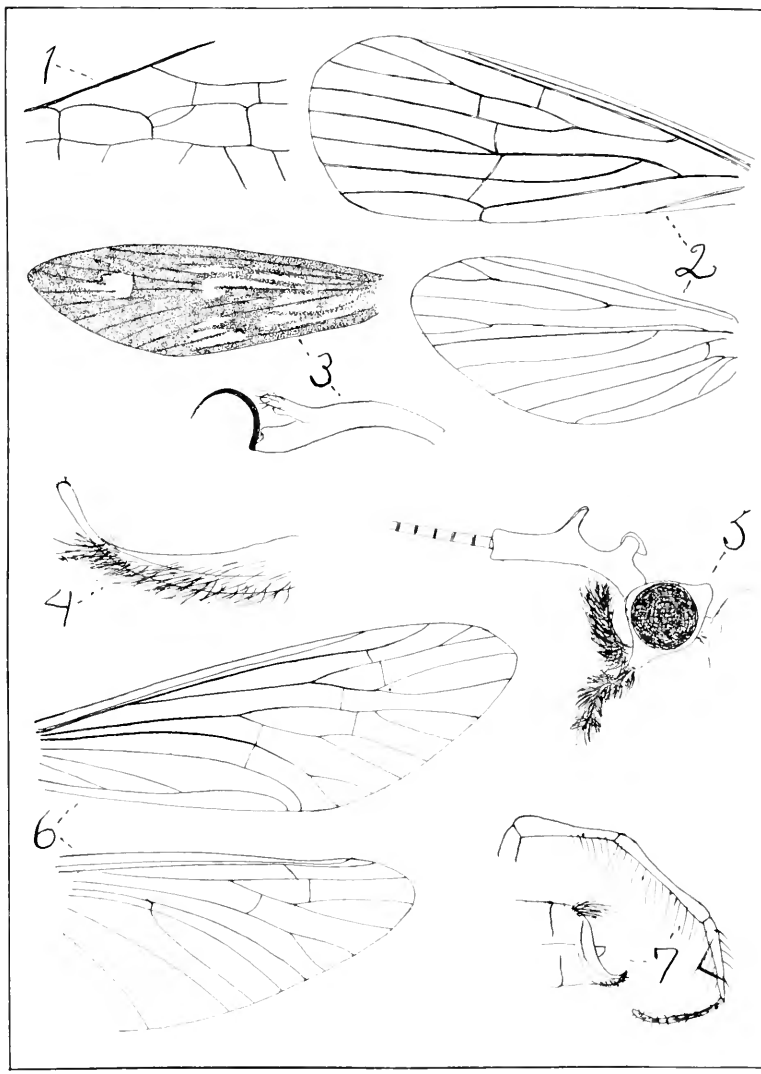
DESCRIPTIONS OF NEW PARASITIC HYMENOPTERA.

By S. A. Rohwer, *Bureau of Entomology.*

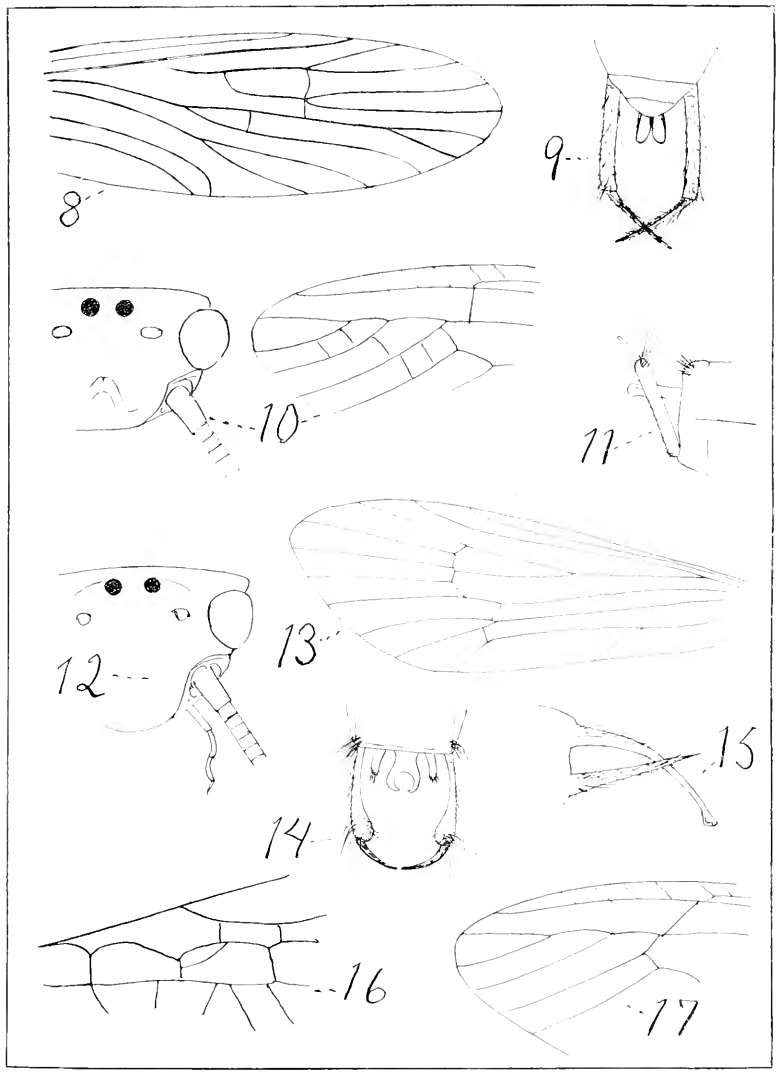
The following miscellaneous descriptions of new parasitic Hymenoptera are presented at the present time so that the names of certain species which have proven to be of economic importance in controlling forest insects and other injurious insects will be made available for discussion in economic papers.

Ichneumon brunneri, n. sp.

Seems to belong to the group of *Barichneumon* and runs there in Ashmead's table of the genera, but Morley says that this group



CHARACTERS OF NEUROPTEROID INSECTS FROM PHILIPPINES.



CHARACTERS OF NEUROPTEROID INSECTS FROM PHILIPPINES.

has the post-petiole punctured centrally, which is not the case with our species. In Cresson's synopsis of American Ichneumons this runs near *cæruleus* but the black scutellum and other color characters will readily separate it from that species.

Female. Length, 11 mm. Anterior margin of the clypeus produced into a low, obtusely triangular, median tooth; supraclypeal foveæ punctiform, deep; the median basal portion of the supraclypeal area convex, separated from the bases of the antennæ by a distinct carina; anterior ocellus in a broad, shallow depression; postocellar line one-third longer than the ocellocular line; flagellum filiform, first joint slightly longer than the second; face and front with distinct well defined separate punctures; vertex and posterior orbits nearly impunctate; mesoscutum granular with dense setigerous punctures; scutellum more sparsely punctured than the scutum; mesepisternum punctured similarly to the scutellum; sides of the propodeum sculptured like the mesepisternum; posterior aspect of the propodeum with large, confluent, close, punctures; basal lateral area with rather large distinct punctures; areola, basal lateral area and basal area almost impunc-

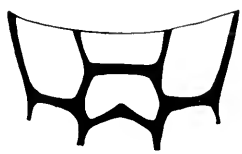


Fig. 1. Areolation of the propodeum of *Ichneuman brunneri*.

tate; areolation as in figure 1; the central portion of the post-petiole finely, longitudinally acieulate; gastrocoeli well defined; basal portion of the second tergite longitudinally striate, the remaining portion longitudinally striato-punctate; the base of the third and fourth segments striato-punctate, the remining portion sparsely punctured, following segments practically impunctate; apical sternite truncate apically; empodia large, well defined, median portion membranous; legs normal; areolet pentagonal. Dark blue black; inner margin of the eyes almost to the vertex, spot at the summit of the eye, posterior margin of the eye, lateral margin of the dorsal posterior margin of the pronotum, top of mesepisternum, an incomplete annulus on the ninth, tenth, eleventh and twelfth joints of the flagellum and anterior tibiæ beneath, *white*; wings hyaline, venation black.

Male. Agrees well with above description of female except in the following points: The antennæ are somewhat antenniform; the clypeus is nearly truncate; and the color differs as follows: Mandibles except apices, clypeus, face marks produced inwardly so they meet, just below the antennæ, scape beneath, base of the anterior tarsus, base of the four posterior tibiæ, and the base of the four posterior basitarsi, *white*.

Missoula, Montana. Described from one male and one female recorded under Bureau of Entomology Number Hopk. U. S. 11526. Material collected January, 1913, and reared by Joseph Brunner, for whom the species is named. The female is the type.

Type: Cat. No. 16032, U.S.N.M.

Itoplectis plesia, n. sp.

Judging from the description this resembles *Pimpla behrensi* Cresson, but may be separated from that by the shorter ovipositor and in not having the apical margin of the tergites yellow.

Female. Length, 9 mm.; length of ovipositor 5 mm. Apical margin of the clypeus straight; front with the distinct, well defined, separate punctures, which become more widely separated towards the inner margins of the eyes; seen from the side, the entire front is gently convex; the antennal foveæ sharply defined below; area immediately below and between the antennæ depressed into a V-shaped fovea, the apex of the V being ventral; the distance between the eyes at the vertex slightly less than the distance between them at the clypeus; the emargination is broad; head above the antennæ and the posterior orbits shining, practically impunctate, straight above the inner bases of the antennæ; ocellocular line subequal with the width of the lateral ocellus; third antennal joint but little shorter than the fourth and fifth combined; mesoscutum shining with widely separated setigerous punctures; mesepisternum similarly sculptured; scutellum and propodeum similarly sculptured; dorsal aspect of the propodeum with two well defined diverging carinæ which extend to where the sloping posterior face begins; first tergite with sparse well defined punctures except the median apical area which is practically impunctate; the second tergite with large, sometimes confluent punctures except the apical margin which is practically impunctate; basal margin with two elongate foveæ, just before the apical margin depressed, the depression broader laterally; the third tergite similar to the second except there is no fovea basally; the fourth tergite similar to the third but not quite so densely punctured; the fifth and following tergites with sparse punctures. Black; tegulae white; legs below the coxæ rufo-ferruginous; the intermediate tibiæ annulated at the base with black, and below the black annulation is a white annulation; posterior tibiæ and tarsi black, the tibiæ with a white annulation at the basal third, the base of the first and second tarsal joints white; calcaria white; the intermediate tarsi have the two basal joints white at the base; wings hyaline iridescent, venation black.

Camas, Montana. Described from one female recorded under Bureau of Entolomogy Number Hopk. U. S. 11528. Material collected, January, 1913, and reared by Joseph Brunner.

Type: Cat. No. 17063, U.S.N.M.

STILBOPOIDES n. genus.

The inner margin of the eyes not emarginate, slightly converging towards the vertex; clypeus well separated from the front, the anterior margin rounded; mandibles bidentate; malar space a little shorter than the length of the scape; antennæ of the female thickened apically with the apical joint elongate and slightly longer than the two preceding it; antennæ of the male simple, almost as long as the body; front slightly convex; propodeum exareolate, posterior face separated from the dorsal aspect by strong carina; spiracles circular in outline; anterior wings with an areola; nervulus well beyond the basal vein; nervellus broken slightly below the middle; claws apparently simple but seen magnified 35 dianeters, finely pectinate; apical joint of the hind tarsi not quite twice the length of the preceding one; first, second and third tergites transversely depressed apically; abdomen coarsely punctured.

In Schmiedeknecht's classification this genus runs to *Cnemopimpla* Cameron, but differs in a number of points from the original description of Cameron's genus. The eyes are not sinulate on the inner margin and the areola is triangular, as well as other characters. In Ashmead's classification this runs to *Stilbops* Förster, but the exareolate propodeum will readily separate this from *Stilbops*.

Type: Stilbopoides maculiventris, n. sp.

Stilbopoides maculiventris, n. sp.

Female. Length, 10 mm. Head polished, rather densely punctured, posterior orbits shining, practically impunctate; postocellar line about twice as long as the ocellocular line; first joint of the flagellum distinctly longer than the second; the scutum, scutellum, and episternum shining, with small well separated punctures; propodeum closely, sometimes confluently punctured with the carina separating the two faces, slightly curved in the dorsal middle; first abdominal segment shining with close well defined punctures laterally, and along the apical transverse furrow striato-punctate; second and third tergites similarly punctured except the punctuation tends to a transverse striato-puncturation; fourth and following tergites finely reticulate, shining. Black; spot on the clypeus orange yellow; spot on the mandibles, tegulæ, posterior margin of the pronotum, apices of the coxæ beneath, anterior trochanters beneath, sternites, except spots laterally, white; sides of the scutum, scutellum, most of the mesepisternum, mesosternum, dark rufous; legs rufo-testaceous, except where mentioned, and the dark brown posterior tibiæ and tarsi; wings hyaline, iridescent, venation black.

Male. Length, 10 mm. Disregarding the sexual characters, the male agrees well with the female except that there is no rufous on the thorax and the apices of the posterior femora are black; first joint of the flagellum slightly longer than the second; posterior ocelli prominent; cochlearium,

seen laterally broad basally, dorsal margin straight for half its distance then tapering rapidly to the obtuse apex; the ventral margin straight, deeply sinulate at the apical third.

Missoula, Montana. Described from two females (one type) and two males recorded under Bureau of Entomology number Hopk. U. S. 11504b. Material collected, January, 1913, and reared by Joseph Brunner.

Type: Cat. No. 15385 U.S.N.M.

Stilbopoides sesiavora, n. sp.

Differs from *Stilbopoides maculiventris* Rohwer in the longer first tergite, in the lack of a median depression on the basal portion of the first tergite, in the narrower, smooth apical margins of the first, second and third tergites, and in the slightly different color.

Female. Length, 12 mm. Clypeus with the apical portion smooth, apical margin truncate the basal portion sculptured as the front; the lateral supraclypeal areas shining, very finely punctured; the median supraclypeal area mound shaped, with distinct, fine, separated punctures; head above the antennæ shining, very sparsely punctured; laterad of each lateral ocellus is an elongate fovea; postocellar line one-third longer than the ocellocular line; scape strongly dilated; third antennal joint slightly longer than the fourth; mesoscutum with distinct well defined separate punctures; scutellum with punctures more widely separated; mesepisternum shining, very sparsely punctured, especially posteriorly; propodeum truncate posteriorly; the posterior aspect separated from the dorsal aspect by a well defined carina; posterior and lateral aspects shining, with sparse, well defined, rather large punctures; the median area shining and more or less U-shaped; the posterior face very sparsely sculptured with distinct well defined punctures, in outline semicircular; first tergite about one-third longer than the apical width, the posterior median portion with a distinct depression, punctured similarly to the dorsal aspect of the propodeum except posteriorly they become closer; the median apical margin of the first tergite shining, impunctate; second tergite sculptured about as the densest portion of the first tergite; its puncturation becomes denser posteriorly, its apical margin with a narrow, shining, impunctate band; third tergite uniformly sculptured like the posterior portion of the second tergite; it also has a narrow, shining, impunctate band; fourth tergite sculptured as the third tergite except that the apical margin before the shining, impunctate band is depressed into a furrow which is interrupted medianly; fifth tergite with poorly defined punctures; the following tergites practically impunctate with the surface finely granular; venation and legs as in *maculiventris*. Black; mandibles except apices, apical portion of the clypeus, anterior superior orbits, lateral anterior stripes on the mesoscutum, tegulæ,

a spot before and beneath and a spot in front of intermediate coxæ, *white;* legs rufo-ferruginous; the anterior coxæ and trochanters beneath, the bases of all the tibiæ white; the posterior tibiæ and tarsi to the extreme apices of the posterior femora black; membrane of the sternites white with black maculations laterally; wings hyaline, faintly dusky; venation black.

Male. Length, 10 mm. Agrees well with the above description of the female but for the usual sexual characters, and in having the clypeus entirely, the inner orbits to vertex, and two spots extending from the clypeus to the bases of the antennæ and an elongate spot on the mesepisternum below, *white.*

Winchester, Virginia. described from three females (one type) and one male recorded under Bureau of Entomology Number Quaintance 10401. Specimens reared by E. B. Blakesley, April 20, 1913, from *Sesia pyri.*

Type Cat. No. 16854, U.S.N.M.

Genus Helcostizus Foerster.

Syn. *Asternaulax* Viereck, Proc. U. S. Nat. Mus. vol. 42, 1912, p. 632.

A comparison between *Asternaulax fiskei* Viereck and *Helcostizus brachycentrus* (Gravenhorst) revealed no generic differences. The writer is of the opinion that Ashmead was correct in placing *Helcostizus* in the *Xoridini.* To him the habitus is *Xoridini* not *Phygadonini,* where Schmiedeknecht places it, and the complete absence of sternauli would also remove it from *Cryptinæ.* As far as the American species of *Echthurus* Gravenhorst are concerned he is of the opinion that they should be placed in the subfamily *Cryptinæ* as they all have sternauli. In other words the Pimplinæ includes genera in which the sternauli are wanting.

Helcostizidea, n. genus.

Cubocephalus Ashmead (nec Ratzeburg) Proc. U. S. Nat. Mus. vol. 23, 1910, p. 61.

This genus has somewhat the habitus of some of the *Cryptini,* but differs from all *Cryptini* in the absence of the sternauli. It resembles them however, in that the spiracles on the first tergite are placed slightly beyond the middle.

Head, seen from above, quadrate or nearly so; temples broad; malar space as long or nearly as long as diameter of the eye, mandibles short, bidentate apically; apical margin of the clypeus depressed; scape strongly convex dorsally, straight ventrally, longer on the dorsal line than on the ventral line; prepectus represented by faint carinæ; sternauli obsolete; scutum without furrows; propodeum areolate, the areola sometimes con-

fluent with the basal area, though usually separated from it by a transverse carina; areolet triangular; nervulus and basal vein interstitial or nearly so; discal-cubital vein not broken by stump; nervellus broken well below the middle; first abdominal segment petiolate, the spiracles placed slightly beyond the middle; abdomen of the female slightly compressed apically; legs robust; calcaria short; tarsal claws with an erect median tooth, and with small teeth basally.

Type: Cubocephalus atrocoxalis Ashmead.

Related to *Helcostizus* Foerster but separated from it by the well defined areola. *Cubocephalus* Ratzeburg has sternauli and belongs to the Cryptinæ.

Helcostizidea xanthognatha, n. sp.

This species resembles *atrocoxalis* (Ashmead), but may be separated from it by the posterior legs of the areola being much shorter than the anterior legs.

Female. Length to the apex of the abdomen, 14 mm. Antennæ filiform; head finely granular; the area immediately above the antennæ depressed, the depression extending ventrally from the anterior ocellus; the intra-ocellar area divided by short, longitudinal furrow; posterior ocelli bound posteriorly and laterally by a deep furrow; postocellar line distinctly longer than the ocellocular line which is about twice the diameter of the lateral ocellus; scutum shining, very sparsely punctured, although anteriorly the punctures are closer and become subopaque; scutellum convex, sculptured similarly to the scutum; the suture separating the scutellum and scutum foveolate; lateral posterior margin of the pronotum reticulate; the upper margin of the mesepisternum obliquely striate, the remaining portion punctate on a finely granular surface; suture between the meso- and meta-thorax strongly foveolate; sides of the propodeum sculptured like the mesepisternum; dorsal aspect of the propodeum finely granular; basal area almost parallel-sided, although anteriorly the carinæ diverge, separated from the areola by a poorly defined transverse carina; areola slightly longer than wide posterior parallel legs about two-thirds the length of the anterior diverging legs; surface of the areola and the posterior face of the propodeum transversely striate; abdomen finely granular except the apex and the first tergite which is impunctate; tibiæ with minute spines and short hair. Black; palpi, mandibles except apices and tegulæ, yellowish white; four anterior legs below coxæ, posterior trochanters and the posterior femora rufous, or rufo-ferruginous; the intermediate tarsi dusky; wings hyaline, venation brown; costa and stigma dark brown.

Columbia Falls, Montana. Described from one female recorded under Bureau of Entomology Number Hopk. U. S. 8530a, material collected by Joseph Brunner.

Type: Cat. No. 16047 U.S.N.M.

Apanteles (Pseudapanteles) nigripes, n. sp.

This species is related to *Apanteles (Pseudapanteles) cloreuti* Viereck, from which it may be readily separated by its black legs.

Male. Length, 1.25 mm. Eyes slightly converging towards the clypeus; head below the antennæ shining, sparsely punctured, with a low median hump just above the clypeus; above the antennæ the head is shining, and without well defined punctures; mesonotum opaque with separate well defined punctures; suture between the scutum and scutellum foveolate; scutellum shining, practically impunctate; propodeum opaque with well defined punctures; mesepisternum shining, practically impunctate; sides of the propodeum shining, practically impunctate; first tergite with its length and width subequal, rather coarsely reticulate; second tergite rectangular in outline, about four times as wide as long, and sculptured like the first tergite, but in addition has a faint median carina; the third and following tergites shining, almost impunctate. Entirely black; wings hyaline, slightly iridescent, venation very pale brown.

Falls Church, Virginia. Described from one male recorded under Bureau of Entomology Number Hopk. U. S. 11171d, material collected and reared, July 22, 1913, by Carl Heinrich.
Type: Cat. No. 16472, U.S.N.M.

Campyloneurus busckii, n. sp.

The remarks under *Monogonogastra wolcottii* Rohwer apply to this species as far as its published allies are concerned.

Female. Length, 12 mm.; length of the ovipositor, 12 mm. Antennæ reaching to about the apex of the third tergite; head shining, depressed between the antennæ and the ocelli; the ocelli surrounded by deep, well defined furrow which extends ventrally from the anterior ocellus to between the bases of the antennæ; postocellar line about one-fifth shorter than the ocellocular line; thorax shining, polished; scutellum very little higher than the scutum; embossed median area of the first tergite elongate, much broader posteriorly, defined laterally by a broad depression which is transversely foveolate; embossed area of the second tergite triangular in general outline, but about the apical third narrows into a line and from there on is defined laterally by a broad, shallow, irregularly foveolate depression; suture-formed articulations foveolate; third tergite with a poorly defined embossed median area; laterally this area is defined by a shallow, punctiform depression; tergites shining, impunctate; last sternite extending about the width of the posterior tibiæ beyond the apex of the abdomen. Dark rufo-ferruginous; head except the trophi, antennæ and sheath, black; head and thorax clothed with long, sparse, pale yellowish hair; wings basad of the basal vein yellowish hyaline, the rest dark brown except a transverse yellowish band beneath the stigma; venation dark brown; stigma light yellow.

Male. Length, 12 mm. Barring sexual characters this agrees with the above description of the female.

Trinidad, West Indies. Described from one male (allotype) and one female (type) collected in June by August Busck, for whom the species is named. One paratype collected at Trinidad, March 20, 1913, by T. W. Urich and G. N. Wolcott.

Type: Cat. No. 16021 U.S.N.M.

NOTES ON RHIPIDANDRI (COLEOPTERA).

By H. S. Barber, *Bureau of Entomology.*

In arranging the National Museum specimens of *Rhipidandrus* a number of obstacles were encountered, and it is thought that the following notes may be of use to someone.

Much confusion has resulted from the assignment of the group to different families. In fact, as Mr. Arrow has pointed out (see below, 1904) three species have been described as Scolytids, one (possibly two) as Scarabæids, and one as a Ptinid, while the discussion is still open as to their assignment in the Tenebrionidæ, or in the Cioidæ.

The figure and description of the *Melolontha paradoxa* of Palisot de Beauvois are very unsatisfactory, and it is hard to accept Sallé's statement (see LeConte, 1873) that it is the *Xyletinus flabellicornis* of Sturm. Nevertheless Sallé may have seen the type of the former, and it would be unsafe to repudiate the well-known combination (although omitted in Junk's Catalogus) without further data. Mr. Schwarz and the writer have attempted to associate Beauvois' name with some other South Carolinian beetle, but have failed. The description differs from our *Rhipidandrus* in color, shape of thorax, and sculpture, and from the figure in size, form of posterior part of body, tarsi and antennæ. It is difficult to know where to stop in allowing for error.

In almost a century that the group has been known in technical literature, there has been but one comprehensive article. This one appeared only nine years ago (1904) and does not mention either of our United States species, although it draws together the species that had been misplaced in other families. The contributions to our knowledge of the group, arranged chronologically, but not including various local lists, are as follows:

1805–1821 Palisot de Beauvois (Ins. rec. Afr. et Amer. p. 173. pl. IV. b. fig. 1) describes *Melolontha? paradoxa* from South Carolina (collected by Bose) as a species placed in this genus with great uncertainty.

1826 Sturm (Catalogue p. 59. t. 1. fig. 7) figures the North American *flabellicornis* (work not seen by the writer—citation taken from literature).

1843 Sturm (Cat. Kafer Sammlung. p. 84) includes *flabellicornis* among the species of *Xyletinus* and cites his previous figure (1826.)

1853 Melsheimer (Cat. Coleop. U. S. p. 86) cites *flabellicornis* Sturm under *Xyletinus*.

1854 LeConte (Proc. Acad. Sci. Phil. 1854. p. 218) removes *Xyletinus flabellicornis* Sturm from the Ptinidæ but can give no indication where it should be placed.

1858 Motschulski (Etud. Ent. VII. p. 64) describes *Xyleborus? crenipennis* from Burma and mentions its resemblance to *Hylurgus* and *Hylastes*.

1862 LeConte (Classif. Coleop. N. A. pt. 1. p. 236) included *Rhipidandrus* (*Xyletinus*) *flabellicornis* Sturm in the Tenebrionidæ as forming Group II. Rhipidandri in the tribe Boletophagini. This is the first characterization of the genus.

1863 LeConte (List. Coleop. N.A. p. 62) lists *Rhipidandrus* (*Xyletinus*) *flabellicornis* in the Boletophagini.

1866 Lacordaire (Genera des Coleop. vol. VII. p. 369) describes *Eutomus*, a new genus in the Scolytidæ and includes two new species, *E. micrographus* the type from Cayenne and Columbia, and *E. madagascarensis*.

1870 Horn (Revis. Tenebr.—Tr. Amer. Philos. Sc. XIV. p. 389) includes *Rhipidandrus flabellicornis* (Sturm) in the Tenebrionidæ with *Eledona*.

1870 Gemminger and Harold (Cat. vol. 7. p. 1946) places *Rhipidandrus flabellicornis* Sturm in the Tenebrionidæ next to *Boletophagus* and notes its removal from *Xyletinus* where the species had been included in the preceding volume (1869) p. 1779.

1872 Gemminger and Harold (Cat. vol. IX. p. 2678) include both of Lacordaire's species of *Eutomus* as he had placed them in the Scolytidæ, and *crenipennis* Mots. (l. c. p. 2685) still appears as a species of *Xyleborus*.

1873 LeConte (Proc. Acad. Nat. Sci. Phil. p. 329 and 335) says "*Melolontha paradoxa* Beauv., according to Sallé, is *Rhipidandrus flabellicornis* (Sturm).

1873 Crotch (Check List Coleop. Am. N. of of Mex. p. 108) lists *Rhipidandrus paradoxus* (Beauv.) with *flabellicornis* (St.) as a synonym in the Tenebrionidae.

1878 Schwarz (Proc. Am. Philos. Soc. XVII. p. 462) lists *Rhipidandrus paradoxus* Beauv., with Tenebrionidæ from Enterprise, Fla.—"rare on fungi."

1882 Horn (Bull. Soc. Ent. Fr. (6) vol. 2. p. CXXXII) gives the sexual differences of *Eutomus micrographus* Lac., and states that the genus is a synonym of *Rhipidandrus* Lec. (1862), being in no sense a Scolytid.

1883 Friedenreich (Stett. Ent. Zeit. 44 pp. 375–379) erects a new genus *Heptaphylla* in the Lamellicornia for *H. fungicola*, n.sp., from South Brazil, and described its larva. (See Arrow, 1904).

1883 LeConte and Horn (Classif. Coleop. p. 232) includes *Rhipidandrus* in the Cioidæ and mentions *Eutomus* as a synonym.

1885 Henshaw (List Coleop. p. 86) drops the synonymy and lists *R. paradoxus* Beauv., in the Cioidæ.

1886 de Borre (Ann. Soc. Ent. Belg. 30. p. 56) erects a new subtribe in the *Trogini*, the *Heptaphyllini* for *Heptaphylea fungicola* Fried. (See Arrow, 1904.)

1889 Fleutiaux et Sallé (Ann. Soc. Ent. Fr. 1889. p. 420) mistook the date of LeConte's genus *Rhipidandrus*, and so made it a synonym of *Eutomus* Lacordaire (1866). They discuss the position of the genus citing Horn's note (1882) and agree that it belongs in the Cisidæ. Lacordaire's species *micographus*, is recorded from Guadeloupe (probably wrongly identified).

1894 Waterhouse (Ann. Mag. Nat. Hist. (6) 14 p. 68) describes a new genus of Cioidæ containing two new species *Cherostus walkeri* (type) from Damma Isl. and *C. simpsoni* from Australia. The genus is compared with *Eutomus* but no species of the latter genus is mentioned.

1894 Horn (Proc. Calif. Acad. Sci. (2) vol. IV. p. 392) describes *Rh. peninsularis* n.sp., from Lower California, and, apparently forgetting his note of 1882 compares it to the Scolytid genus *Eutomus*.

1895 Henshaw (3d Supp. List. Coleop. p. 21) lists *R. peninsularis* Horn.

1898 Gorham (Proc. Zool. Soc. Lond. 1898. p. 333) describes a new species (*Eutomus sulcatus*) from St. Vincent, and records Lacordaire's type species of *Eutomus* (probably wrongly determined) from St. Vincent. Grenada, and Guadeloupe, figuring the species on pl. XXVII, fig. 4).

1904 Arrow (Ann. Mag. Nat. Hist. (7) vol. 14. p. 20–33) corrects some strange errors of classification, and synonymy, and describes two new species (*Cherostus cornutus* from St. Vincent and Grenada, and *jamaicensis* from Kingston.) He removes *Heptaphylla fungicola* Fried. from the Lamellicornia (Trogidæ) to the genus *Rhipidandrus* and accepts *Eutomus* Lac. as a synonym of the same genus, correcting the error in date of publication made by Fleutiaux and Sallé. In his discussion of the species of *Cherostus* Waterh., he removes the *Xyleborus crenipennis* of Motschulski 1858 (from Burma, Ceylon? and the Andaman Islands) and after remarks about sexual characters and a review of the larval characters as described by Friedenreich for *Rhipidandrus* (*Heptaphylla*) *fungicola*, he doubtfully indicates the relationship of the group with the lignivorus *Malacodermata*.

1905 Sharp (Biol. C. A. Coleop. vol. 2, pt. 1. p. 690–692) describes two new species (*Rh. mexicanus* and *championi*) and records a third species

Cherostus cornutus (probably in error)[1] from Oaxaca and Durango. He contends that the resemblance to *Eledona* is not deceptive but genuine, and refers the group again to the Tenebrionidæ as an aberrant group allied to the Boletophagini.

1910 Blatchley (Coleop. of Indiana p. 901) includes *Rh. paradoxus* in the Cioidæ and gives sexual differences in the antennæ, but records its occurrence under bark of oak stumps, rare.

1911 Gebien (Coleop. Cat. Tenebrionidæ III. p. 362) lists six species of *Rhipidandrus*, five species of *Cherostus* and three species of *Eledona* as forming the *Rhipidandrini*, but he omits two species viz. *peninsularis* Horn 1894 and *sulcatus* Gorham 1898, and does not refer to *paradoxus*. (Beauv.). The latter appears as *flabellicornis* Sturm, a name that has been replaced (perhaps wrongly) by Beauvois' name for forty years in the American literature.

Although the generic nomenclature appears simple, the writer believes that an error has been made in accepting Lacordaire's generic name *Eutomus* as a synonym of LeConte's genus. The former's type species is unknown to the writer but its description seems to apply to a species more nearly resembling *Cherostus cornutus* Arrow (which was formerly recorded as *micrographus* Lac.) than to LeConte's genus *Rhipidandrus*. The erection of *Cherostus* by Waterhouse for two oriental species may be justified, but the American species are believed to belong in *Eutomus*.

In regard to the biology, we have only the description of the larvae by Friedenreich (1883) translated by Arrow (1904), and numerous statements that they are found in hard woody fungi. In the experience of Mr. Schwarz and the writer *Eutomus* is usually in company with a brown species of *Arrhenoplita*.

From the following six species, represented in the National Collection, it appears that *Rhipidandrus*, type *flabellicornis* (Sturm. 1826) Lec. 1862, has the antennal rami produced into flabellæ, and is devoid of frontal sexual characters, while in *Eutomus*, type *micrographus* Lac., 1866, the antennal rami are much shorter, so that when closely appressed the antennæ appear clavate and not flabellate, and the frontal sexual characters consist of a pair of clypeal tubercles in the male and a more or less pilose frontal concavity in the female. No oriental species of this group are before the writer, but since Arrow (1904) adopted Waterhouse's genus *Cherostus*, type *walkeri* Waterh. 1894, for his West Indian species, here called *Eutomus cornutus*, it is believed that the former genus will fall as a synonym of the latter.

[1] There is great probability that this is identical with Horn's *Rh. peninsularis* but not with Arrow's *Ch. cornutus* from the West Indies.

Rhipidandrus paradoxa (Beauv.) 1805?

flabellicornis (Sturm.) 1826.

About thirty specimens from the following localities: *Can.*; *Mich.*, Grand Ledge, Detroit; *Kans.*; *Md.*; *D.C.*; *Ky.*, Louisville; *Ga.*, St. Catherine Island; *Fla.*, Crescent City; *La.*, Covington; *Tex.*, Columbus.

No differences in extent of antennal flabellation that might indicate sexes have been noticed in the set, although Blatchley (1910) has alluded to such a difference. The figure and description of *Melolontha paradoxa* by Beauvois are so grossly different from our specimens that it is hard to accept Sallé's statement to LeConte (1873).

?Rhipidandrus championi Sharp 1905.

Two examples from dry fungus at Alhajuela, Canal Zone, Panama, in April, 1911, by August Busck, are much smaller, narrower, and more cylindrical than the preceding, and are remarkable in the clypeus being strongly tumid, highly polished, and of a light reddish brown color, while the antennæ are much less strongly ramose than in *flabellicornis* and more strongly so than in *Eutomus* (*Cherostus*). Length. 1.8 mm., width 0.74 mm.

?Rhipidandrus (**Eutomus**) **sulcatus** (Gorham) 1898.

Three specimens from Cayamas, Cuba, and two from Santo Domingo are similar to *flabellicornis* but are more cylindrical, have a relatively larger head with finer punctation. The antennæ are hardly different from *flabellicornis*.

?Eutomus cornutus (Arrow) 1904.

A large set (about fifty) from Montserratt, W.I. (H. G. Hubbard), and a few from Santo Domingo appear specifically inseparable, and are doubtfully referred to this name. If *jamaicensis* (Arrow 1904) proves to be but a small individual of this species its range would appear to extend throughout the West Indies.

?Eutomus peninsularis (Horn) 1894.

A set of about five hundred specimens was collected by the writer at Brownsville, Texas, May 7, 1904, in a hard brown fungus.[2] Horn's species came from Lower California and no typical material has been seen. A single male from San Diego, Texas, and three specimens (2 males and 1 female) from Tampico, Mexico,

[2] This fungus was determined for me as *Ganoderma pseudoboletus* but I now believe the determination is incorrect.

December 27, 1909, collected by E. A. Schwarz are probably the same species. They are similar to *cornutus*? but are smaller, lighter brown with much paler antennæ, and the males are much shorter than the females.

Eutomus panamaensis n.sp.

Very dark brown, legs reddish, antennae testaceus, sides parallel, body less than twice as long as wide. Head and pronotum alutaceous, or finely reticulate, the ridges shining, the intervals opaque except for a minute polished point in the center of each area; pronotum five-ninths as long as wide. Elytra shining, strongly sulcate, the intervals becoming costæ on each side of which are faint rugosities, and very minute hairs, each pointing obliquely towards the ridge. Length, 3 to 3.5 mm.

Male.—Clypeus with two obtuse horns which are separated by two-sevenths of the interocular space.

Female.—Clypeus tumid, median third smooth, impunctate, front feebly concave, with scattering very short hairs which are scarcely more dense than those on the thorax.

Type: No. 16841 U. S. N. M.

About one hundred and thirty specimens from dry woody fungus were taken at Alhajuela, Canal Zone, Panama, in April, 1911, by Mr. August Busck, among a numerous colony of *Arrhenoplita cioides.*

Differs from the Texan species (supposed to be *peninsularis* Horn) and from the West Indian species (supposed to be *cornutus* Arrow) by its shorter, more robust form, and shining elytra, and by the almost total absence of the frontal pilosity of the female.

Eutomus n. sp.

Specimens of a fourth species of this genus have just been donated to the National Museum by Mr. W. S. Blatchley who collected them at Dunedin, Florida, in January, 1913. Mr. Chas. Dury informs the writer that he expects soon to publish the description of this species in Entomological News. It is much smaller than the three species of this genus above mentioned, being about the size of *Rh flabellicornis.*

INDEX TO VOLUME XV.

LIST OF ERRATA IN VOLUME XV.

Page 74, line 11 from top, for "Burmuda" read "Bermuda."
Page 74, line 17 from top, for "catoirei" read "catoirii."
Page 74, line 2 from bottom, for "sapadillos" read "sapodillas."
Page 98, line 10 from top, for "Snythesiostrebla" read "Synthesiostrebla."
Page 120, line 18 from bottom, for "brevicornis" read "brevicomis."
Page 120, line 10 from bottom, for "brevicornis" read "brevicomis."
Page 168, line 5 from top, for "Gonzales" read "Gonzalez."
Page 168, line 24 from top, omit "the"; after "eggs" insert "presumably of Dermatobia."
Page 191, line 14 from bottom, for "Arrkenoplita" read "Arrhenoplita."

The actual date of publication of volume XV, No. 4, was January 22, 1914.

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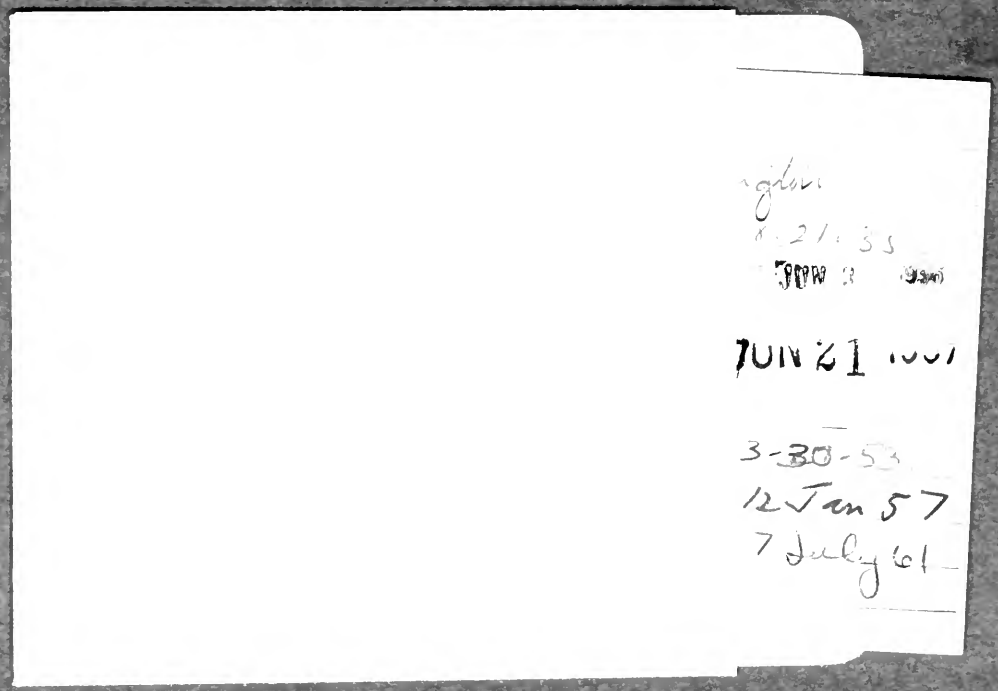
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